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A CASE STUDY OF THE ADVANCED AMPHIBIOUS ASSAULT VEHICLE (AAAV) PROGRAM FROM A CONTRACTING PERSPECTIVE

by

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December 1998

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This research effort focused on the contracting history of the U. S. Marine Corps Advanced Amphibious Assault Vehicle (AAAV) Program. The research answered the primary question of what were the critical contracting decisions that have been made during the program and how would an analysis of these contracting decisions affect the future of the AAAV program. Interviews were conducted with personnel from the AAAV program office and other Government agencies as well as with contractor employees. Additionally, program documents and other relevant literature was reviewed. The key findings of the research effort conclude that the unique collocation arrangement of the AAAV program office and the contractor should be emulated by other Major Defense Acquisition Programs (MDAPs); Integrated Product Teams (IPTs) and the Integrated Product and Process Development (IPPD)

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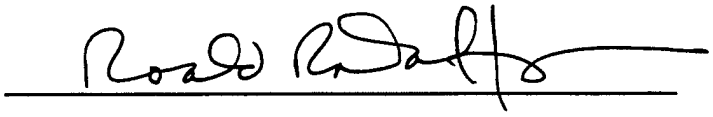
Author: 

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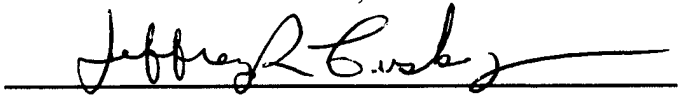

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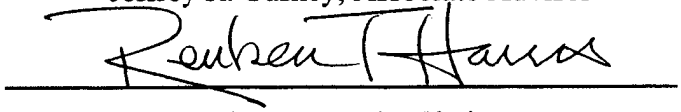

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ABSTRACT

This research effort focused on the contracting history of the U. S. Marine Corps Advanced Amphibious Assault Vehicle (AAAV) Program. The research answered the primary question of what were the critical contracting decisions that have been made during the program and how would an analysis of these contracting decisions affect the future of the AAAV program. Interviews were conducted with personnel from the AAAV program office and other Government agencies as well as with contractor employees. Additionally, program documents and other relevant literature were reviewed. The key findings of the research effort conclude that the unique collocation arrangement of the AAAV program office and the contractor should be emulated by other Major Defense Acquisition Programs (MDAPs); Integrated Product Teams (IPTs) and the Integrated Product and Process Development (IPPD) concept is effective in improving communications between the Government and the contractor; and unique contract clauses used in the Concept Demonstration and Validation contract were effective in incentivizing the contractor. The unique contract clauses examined were: mandatory geographic location of the contractor's facility, collocation of the AAAV program office with the contractor, a Special Design Decision Provision, and contractor cost sharing. The research effort presents recommendations on how these aspects of the AAAV program can be applied to other MDAPs.

TABLE OF CONTENTS

I. INTRODUCTION

A. BACKGROUND

The Department of Defense (DoD) has been under close scrutiny by Congress over the past two decades because of its inability to field major defense acquisitions on time and at cost [Ref. 1:p. 21]. Previous attempts by DoD to reform its acqusition process have met with only limited success. The latest attempt, initiated in 1994, attacks the procurement process by examining every step in the process and determining if there is a better way to do business. Some central themes to the current acquisition reform initiative include adopting commercial business practices, use of Integrated Product and Process Development (IPPD) and Integrated Product Teams (IPTs), Cost As an Independent Variable (CAIV), and use of Performance Specifications vice Military Design Specifications.[Ref. 2]

In 1990, Congress passed the Defense Acquisition Workforce Improvement Act (DAWIA) which mandated that DoD establish a professional acquisition workforce. Congress intended for this professional workforce to improve DoD's poor acquisition record by providing a core of experienced personnel to manage these complex programs [Ref. 3].

Program Managers (PM) for major defense acquisition programs face a daunting challenge to keep their program within stated cost, schedule, and performance

parameters. They have many tools available to assist them in managing their programs but there is no substitute for experience. PMs must draw upon the experiences of others to avoid repeating another's mistakes. Lessons learned from a successful program should be published so that everyone within the acquistion community can see which initiatives were successful and which ones were not. This case history examines lessons learned from the AAAV program that can be applied to other major defense acquisition programs.

In the early 1970s, the Marine Corps realized that it would eventually need to replace the Amphibiuous Assault Vehicle (AAV) in service at that time [Ref. 4]. The Advanced Amphibious Assault (AAA) concept was developed to meet the evolving doctrine of quickly inserting Marines ashore from ships over-the-horizon. After various alternatives were explored, it was determined that a vehicle would best meet the needs of the AAA concept.[Ref. 5:p. 2]

The Marine Corps Advanced Amphibious Assault Vehicle (AAAV) program was initiated, canceled and restarted three times during the 1970s to the mid 1980s [Ref. 4]. The AAAV program was finally approved and a Program Management Office (PMO) that focused solely on the AAAV was formed in 1990 [Ref. 6:p. 2]. Two contractors, General Dynamics and United Defense Limited Partnership (formerly known as the Food Machinery Corporation (FMC)), were used during the Concept Exploration phase to develop the best concept to meet the needs of the Marine Corps [Ref. 5:p. 2]. Following the Milestone I decision, General Dynamics was awarded a Cost-Plus-Award-Fee

(CPAF) contract to develop the AAAV prototype during the Program Definition/Risk Reduction (PDRR) phase [Ref. 7]. During this phase, several unique requirements were placed on the contractor. First, the contractor was given a geographic region (Northern Virginia) in which to locate its facility. Second, the PMO was required to be collocated with the contractor. Finally, the contractor would use an Integrated Product and Process Development (IPPD) program with Integrated Product Teams (IPTs) consisting of both contractor and Government employees.[Ref. 7] These requirements significantly changed the environment in which both the PMO and contractor worked. It also had a significant impact on the way day-to-day business was conducted.[Ref. 7]

The collocation, IPTs and CPAF contract have provided many advantages during the PDRR phase of the AAAV program.[Ref. 7] There have also been many challenges to overcome since these management techniques had not been used in this fashion in a Major Defense Acquisition Pprogram before. Another issue that arose due to this unique arrangement is the use of the Defense Contract Management Command (DCMC) to administer contracts.[Ref. 8] Issues regarding the need for DCMC to provide an Administrative Contracting Officer (ACO) given the collocation of the PMO and the contractor; and whether the PMO itself can administer the contract have yet to be answered.

Despite the challenges faced during this era of acquistion reform, the AAAV PMO has flourished. It has been recognized as a model PMO and can certainly teach many valuable lessons that can be used by other PMOs.[Ref. 9]

B. RESEARCH OBJECTIVE

The objective of this research is to examine the contracting decisions made during the early phases of the Advanced Assault Amphibious Vehicle (AAAV) program. The goal is to determine what impact these decisions had on the AAAV program at the time, the future implications of these decisions and to determine if these decisions can benefit other major defense acquisition programs. The research included conducting a thorough review of all available program documents, conducting interviews with present and former program management and contracting personnel, conducting interviews with representatives from the two contractors competing for the project, and conducting an analysis of these critical decisions.

C. RESEARCH QUESTIONS

The primary research question is: What have been the critical contracting decisions and events regarding the Advanced Assault Amphibian Vehicle (AAAV) program and how have these affected the nature and scope of the AAAV as it exists today and how will an analysis of these critical elements affect the development, production, and deployment of the AAAV? The subsidiary research questions are as follows:

1. What was the Advanced Assault Amphibian (AAA) concept and how did it lead into the establishment of the Advanced Assault Amphibian Vehicle program?

2. What was the initial acquisition strategy of the AAAV program and how has it evolved?

3. What was the organizational structure used to effectively execute the acquisition strategy of the AAAV program?

4. What have been the contracting vehicles used during the AAAV program and how effective have they been?

5. To what extent has the AAAV Project Management Office (PMO) used special contract clauses?

6. What impact has the Integrated Product Team/Integrated Product and Process Development (IPT/IPPD) process had on the contracting effort within the AAAV program?

7. How might an analysis of contracting decisions made in the early phases of the AAAV program be used in the successful execution of other defense acquisition programs?

D. SCOPE

The scope of this case study is limited to determining what contracting lessons can be learned from the AAAV PMO. The study will analyze the contracting decisions made within the PMO and determine whether or not they can be applied to other MDAPs. The study will also evaluate the contracting organization to determine whether or not it can be applied to other major systems acquisitions as well.

E. METHODOLOGY

The methodology used in this research consisted of the following: (1) a literature search of books and magazine articles relating to amphibious operations and equipment, (2) a review of available AAAV program related material, and (3) personal and telephonic interviews with personnel assigned to the PMO, DCMC, Marine Corps Systems Command, and General Dynamics.

F. ORGANIZATION OF THE STUDY

This thesis is organized in the following manner: Chapter I presented the background and research questions for the study. Chapter II contains a historical perspective of amphibious assault vehicles from their introduction into the Marine Corps in the 1930s through the current AAAV program. Chapter III contains an explanation of the contracting history of the AAAV program, contracting organization, contract types and contract clauses, as well as the source selection process. Chapter IV examines the critical contracting decisions that have been made in the AAAV program. Finally, Chapter V contains the conclusions drawn from the research and recommendations for actions that can be taken.

II. BACKGROUND

A. INTRODUCTION

This chapter will cover the history of amphibious assault vehicles in the Marine Corps, the doctrinal changes that led to the establishment of the Advanced Amphibious Assault Vehicle (AAAV) program, and the establishment of the Direct Reporting Program Manager for Advanced Amphibious Assault (DRPM AAA) Program Management Office (PMO). The Marine Corps has been developing and refining amphibious doctrine since 1920, when the Commandant of the Marine Corps was told by the Chief of Naval Operations to develop a structure that would allow for the seizure of advanced naval bases.[Ref. 10:pp. 6-8] Amphibious doctrine continued to slowly evolve over the next 78 years. Amphibious assault vehicle capabilities improved as new technologies were identified.

B. AMPHIBIOUS ASSAULT

The National Security Act of 1947 stated: [Ref. 11: p. 51]

> The Marine Corps shall be organized, trained and equipped to provide fleet marine forces of combined arms, together with supporting air components, for service with the fleet in the seizure or defense of advanced naval bases and for the conduct of such land operations as may be essential to the prosecution of a naval campaign.

Section 5013 (b) of the Act states "The Marine Corps shall develop...those phases of amphibious operations that pertain to the tactics, techniques, and equipment used by the landing force."[Ref. 6:p. 1] Therefore, by law, the Marine Corps is required to maintain the ability to conduct amphibious assault operations and to develop the equipment necessary to conduct such operations.

An amphibious operation is an attack launched from the sea by naval and landing forces, embarked in ships or craft involving a landing on a hostile or potentially hostile shore. [Ref. 12] An amphibious assault is the principal type of amphibious operation, with the remaining types being a raid, a demonstration, and a withdrawal. Conducting amphibious operations is nothing new to the Marine Corps. On March 3, 1776, a short four months after the Marine Corps was established, Marines conducted their first amphibious operation - an amphibious raid on New Providence, Bahamas.[Ref. 13] This would be the first of countless successful amphibious operations conducted by the Marine Corps in its illustrious history. The Marine Corps' last major amphibious operation was the amphibious assault at Inchon, Korea in 1951 that turned the tide in the Korean War.[Ref. 13]

C. AMPHIBIOUS DOCTRINE

Although the Marine Corps has always maintained a maritime orientation, it expended little effort toward developing amphibious assault doctrine before the British disaster at Gallipoli in 1915 [Ref. 11:p. 72]. Prior to this landing, the doctrine for

assaulting across a defended beach had not been developed. The difficulties encountered when assaulting across a defended or prepared beach are numerous, to include offshore mines, beach obstacles, prepared defensive positions, and emplaced defensive weapons. [Ref. 11:p. 72] The disaster at Gallipoli and the Navy's involvement in War Plan ORANGE, a contingency plan developed in 1915 for war with the Japanese in the Pacific, provided some visionary Navy and Marine Corps officers the opportunity to focus on amphibious assault operations and develop the doctrine [Ref. 11:p. 73]. By 1920, the Navy recognized that in order to defeat Japan in the Pacific, they would need to capture Japanese-held islands and territories to establish advanced bases for coal and other logistic support purposes. Planning for such operations fell to the Marine Corps. [Ref. 11:p. 74]

One Marine officer who had been studying this possibility was Major Earl H. Ellis. Since 1912, Major Ellis had been convinced that the United States would eventually go to war with Japan, and that the United States would have to battle its way across the Pacific to defeat the Japanese.[Ref. 11:p. 76] Major Ellis was also convinced that the United States would have to assault Japanese-held islands in the Pacific to establish the advanced naval bases needed to win the war. After extensive study, Major Ellis wrote a study entitled "Advanced Base Operations in Micronesia" in 1920-21 [Ref. 11:p. 77]. Uncanny in its accuracy, Major Ellis outlined in detail how he saw the western drive across the Pacific occurring. He predicted the need to establish advanced support bases in the Marshall and Caroline Islands to meet the needs of the naval fleet.

So thorough was his study, it was adopted by the Joint Board of the Army and Navy and called the "Orange Plan." [Ref. 11:p. 77].

Many Marine Corps leaders agreed with Major Ellis' study. In preparation for executing the "Orange Plan," the Marine Corps held numerous training exercises throughout the 1920's designed to develop the skills necessary to conduct amphibious operations. Many worthwhile lessons learned were obtained from these early exercises, which later assisted in the initial development of amphibious doctrine. Training and equipment deficiencies were also identified during these early exercises. The need for specialized landing boats was seen as a critical equipment deficiency, a deficiency that would take over a decade to resolve. The training deficiencies could be corrected more quickly by developing amphibious doctrine [Ref. 11:pp. 78-80].

An amphibious assault is one of the most complex military operational maneuvers. The noted British historian B. H. Liddell Hart stated that making such an assault is difficult, almost impossible.[Ref. 11:p. 72] Because of the difficulties involved in conducting an amphibious assault, writing the doctrine would not be easy. The issues that had to be addressed included: how to get equipment and weapons across any reefs and through the heavy surf; how to coordinate fire support from naval vessels and aircraft; how to coordinate the landing of assault forces across separate beaches; and how to combat load unit equipment and supplies. [Ref. 11:pp. 72-79] Fortunately for the Marine Corps, there were officers willing to tackle this monumental effort.

In 1933, all Marine Corps officers, staff and student alike, at the Marine Corps Schools in Quantico, Virginia were directed to capture in writing everything that affected the landing force during an amphibious assault. All officers received a brief on the mistakes made by the British at Gallipoli, and were provided all available information on assault landing operations, which was limited. Using his own past experiences and reasoning, each officer then wrote what he thought were the proper sequence of events for conducting an amphibious assault. After seven months of dedicated effort, the Tentative Manual for Landing Operations, 1934, was published. This manual became known as LFM 0-1.[Ref. 14:p. 34] Although it needed more work, LFM 0-1 captured the essence of the concepts related to amphibious assault and provided the framework for future refinement. Over the next several years, it was revised and updated. In 1938, the Navy adopted it as Fleet Training Publication No. 167, Landing Operations Doctrine, U.S. Navy. The Army published LFM 0-1 in 1941 as Field Manual 31-5. Little changed in either the manual itself or in Marine Corps doctrine over the next 50 years.[Ref. 11:pp. 79-82].

D. EARLY AMPHIBIOUS ASSAULT EQUIPMENT

Now that doctrine was being developed, the Marine Corps turned its focus on procuring the equipment necessary to conduct an amphibious assault. The Marine Corps needed equipment that could transport Marines, and their heavy weapons and equipment, from Navy ships to the shore. As late as the winter maneuvers of 1936-1937, the Marine

Corps still had no practical way to rapidly build up combat power ashore. [Ref. 11: p. 90] By the time World War II broke out, two pieces of amphibious assault equipment had been fielded. One was the Landing Craft, Vehicle and Personnel (LCVP), more commonly referred to as the Higgins Boat. The second was the Landing Vehicle, Tracked Model 1 (LVT 1) Amphibian Tractor, more commonly referred to as an amtrac.[Ref 15:p. 69]

1. The Higgins Boat

The Higgins boat was named after its developer, Andrew Jackson Higgins. Higgins designed his boat, called the Eureka, in 1924 for use by rumrunners in the Mississippi Delta region. The design of the Eureka, a shallow draft thirty-six foot boat with a protected propeller, allowed the boat to conduct beach landings to offload its cargo, and then retract itself. [Ref. 11:p. 92]

Higgins had tried to interest the Navy in his boat, first in 1926 and every year thereafter, but to no avail [Ref. 11:p. 92]. The Marine Corps became aware of Higgins' boat in 1934 and immediately recognized its utility in amphibious operations. After three years of Marine Corps pressure on the Navy's Bureau of Construction and Repair (later called the Bureau of Ships), the Navy finally procured one of Higgins' boats in 1937. Higgins' boat and several boats designed by the Bureau of Ships were tested during amphibious exercises in 1939 and 1940. At the end of the exercises, the Marine Corps determined that Higgins' boat best met their needs.[Ref. 11:pp. 92-94]

The prospect of going to war with Japan continued to grow. Anticipating the upcoming conflict, in 1941 the Marine Corps asked Higgins to modify his Eureka boat to include a bow ramp for landing small vehicles [Ref. 11:p. 94]. This was an idea borrowed from the Japanese. The Marine Corps also asked Higgins to design a landing craft that could carry an eighteen-ton tank [Ref. 11:p. 94]. Working quickly, and at his own expense, Higgins modified two Eureka boats to include a bow ramp and converted an existing lighter into a landing craft, with bow ramp, capable of carrying an eighteen-ton tank. After undergoing successful evaluation by a board from the Marine Corps and the Navy, the Navy ordered two hundred of Higgins' boats. The tank-carrying landing craft designed by Higgins had a much slower route to acceptance. After a year of tests, the Higgins-designed tank landing craft won the competition and all subsequent tank carriers were constructed using Higgins' design. [Ref. 11:p. 98] At last, the Marine Corps had a suitable landing craft for conducting amphibious assaults.

2. The Amtrac

The Higgins boat went a long way toward meeting the Marine Corps' equipment needs for conducting amphibious assaults in the Pacific. However, it fell short in two critical areas.[Ref. 11:p. 100] First, the Higgins boat could not cross the coral reefs that surrounded many of the islands the Marines needed to capture. Oftentimes, the water over the coral reef was too shallow for the Higgins boat to safely cross. Additionally, the water around the reef was very choppy due to the surf breaking over the coral. Secondly,

the Higgins boat did not provide the Marines with the capability to quickly push supplies and equipment off of the beach, where it was vulnerable to enemy fire. This limitation proved disastrous for the British at Gallipoli, and the Marine Corps did not want to repeat this mistake.[Ref. 11:p. 100]

The Marine Corps saw a potential solution to these problems after an article appeared in the October 4, 1937 issue of Life magazine [Ref. 10:p. 32]. The article described a vehicle that was designed to operate in the water and on the land, and was capable of travelling over coral and through mud and shoal water. The vehicle, designed and built by Donald Roebling, was developed as a rescue vehicle for people lost in the Everglades or stranded by tropical storms. John Roebling, a wealthy industrialist, saw the need for such a vehicle after a devastating hurricane struck Florida in 1928, killing scores of people because no rescue vehicle existed that could navigate the Everglades or deliver needed supplies. [Ref. 11:p. 100] John Roebling directed his son, Donald, to design a vehicle that "would bridge the gap between where a boat grounded and a car flooded out." [Ref. 16:p. 54] In addition to meeting the needs of people living in the Everglades, John Roebling also saw the commercial potential for such a rescue vehicle outside the Everglades. [Ref. 10:p. 24]

In 1933, Donald Roebling began designing his water rescue vehicle, which he first tested in 1935. The vehicle, known as the "Alligator," could achieve 2.3 miles per hour on the water and 25 miles per hour on the land.[Ref. 10:p. 26] For the next two years, Donald Roebling worked to correct its many deficiencies. During this time, Roebling

improved the Alligator's water and land speed, reduced its weight, enhanced its maneuverability, and increased the reliability of the track system. By 1937, Donald Roebling had built the versatile rescue vehicle that his father envisioned.[Ref. 10:pp. 24-33]

The Marine Corps began evaluating the Alligator in 1938 and soon became convinced that it could provide the combat assault capability required in the Pacific to secure advanced naval bases. The Marine Corps knew it had to act fast, as signs of war with Japan were growing.[Ref. 11:p. 102] After conducting a series of exercises over the next two years, Marine Corps representatives met with Bureau of Ships representatives and Donald Roebling to discuss the Alligator's deficiencies and to develop a production model for the new Alligator. This new vehicle became known as the Landing Vehicle, Tracked Model 1 (LVT-1).[Ref. 15:p. 69] The LVT-1 could achieve 7 miles per hour on the water and 18 miles per hour on the land, and had a cargo carrying capacity of 4000 pounds. In August 1941, just six months after the production decision was made, the Marine Corps accepted delivery of its first LVT-1. [Ref. 10:p. 46]

The LVT-1 saw its first combat action in the assault on Guadalcanal in August 1942, serving primarily as a logistics vehicle transporting supplies from Navy ships to supply dumps ashore [Ref. 11:p. 105]. The LVT continued its primary role as a logistics vehicle in subsequent amphibious assaults until November 1943, the landing at Tarawa [Ref. 15:p. 69]. For the first time, LVTs were used to transport Marines on the initial assault. Although nearly half of the LVTs were disabled by enemy fire during the

assault, the LVT proved to be effective in transporting the assault force.[Ref. 11:pp. 105-108] The LVT now had a second mission – serving as an armored personnel carrier during the amphibious assault. However, the amtrac was not formally designated an assault amphibian until 1977, 34 years after proving its worth on the bloody beaches at Tarawa. [Ref. 15:p. 70]

The LVT continued to be improved and modified during World War II. One significant improvement was the addition of a stern ramp. [Ref. 15:p. 70] Stern ramps eased cargo handling, permitted the landing of small vehicles and weapons, and allowed assault forces to storm the beach straight from the LVT without having to climb over the vehicle's sides. By the end of the war, four cargo variants and two assault gun variants had been produced. All together, 18,816 LVTs were produced during World War II. [Ref. 15:p. 71]

As a testimony to the significant role the LVT played during the war, the Commanding General, III Marine Amphibious Corps, MajGen Roy S. Geiger, wrote:

> Except for the "amtracs" it would have been impossible to get ashore on Tarawa, Saipan, Guam or Peleliu without taking severe if not prohibitive losses. But, their use is by no means limited to the assault waves; after landing troops and equipment, they play an indispensable part in the movement of supplies, ammunition, et cetera, ashore. In fact, the whole ship-to-shore movement in the normal amphibious operation is to a considerable extent dependent on one or more of the "amtrac" family. [Ref. 15:pp. 73-74]

By the end of World War II, the amtrac had earned its place in Marine Corps amphibious assault operations.

3. Fielding the LVT(P)5

The amtrac once again proved itself during the 1st Marine Division's assault on Inchon and the subsequent liberation of Seoul during the Korean War [Ref. 15:p. 74]. Throughout the war, amtracs served as armored personnel carriers, logistics vehicles, and self-propelled artillery.

In 1953, the Marine Corps fielded the LVT(P)5 as the replacement for the LVT(3)C. This was the first new version of the LVT since World War II. The LVT(P)5 provided increased performance and more importantly, included several variants. These variants consisted of recovery, command, engineer support, and fire support (105mm howitzer mounted in the turret) vehicles. [Ref. 15:p. 74]

The LVT(P)5 saw considerable action during both the Korean War and the Vietnam War, where it participated in most of the 62 landings made by Marines. During the Vietnam War, the amtracs showed their versatility once again by also serving as armored personnel carriers, logistics vehicles moving supplies across inland waterways, patrol vehicles both ashore and afloat, and even serving in an infantry role near the Demilitarized Zone. [Ref. 15:p. 75]

4. Fielding the LVTP7

After nearly 20 years of service, the LVT(P)5 was finally replaced. In 1972, the Marine Corps began fielding the cargo version of the LVTP7 and shortly thereafter, a recovery and a command variant. Fielding was completed in 1974. No successor to the

LVT(P)5 engineer support and fire support variants were produced. The LVTP7, the first water-jet propelled amphibian vehicle, provided the Marine Corps with an amphibious vehicle capable of reaching a water speed of six knots. The drawbacks to the LVTP7 included a reduced troop-carrying and cargo-carrying capacity, which was now limited to 25 troops or 10,000 pounds of cargo. [Ref. 15:p. 75]

In 1977, the LVT was renamed the Amphibious Assault Vehicle (AAV) in recognition of its mission change. The role of the AAV changed from combat service support to combat support. In addition to its role in amphibious assaults, the AAV would be used more extensively in a mechanized role during operations ashore. This would allow combat forces to take advantage of the AAV's mobility, protection from small arms fire, and protection in a Nuclear, Biological and Chemical (NBC) environment. [Ref. 17:pp. 2-3]

The planned service life of the LVTP7 was ten years. Since no replacement was ready, a Service Life Extension Program (SLEP) was begun in 1982 to extend the vehicle's service life to 1994. A Product Improvement Program (PIP) was initiated in 1985 to extend the life of the LVPT7 to the year 2004. The PIP included an automatic fire suppression system, a bow plane, an armor upgrade, and an Upgunned Weapon Station (featuring a 40mm Mk19 Mod 3 machinegun, an M2HB .50-caliber machinegun, and an M257 smoke grenade launcher). In conjunction with the SLEP, the LVTP7 was redesignated the LVTP7A1.

5. The Landing Vehicle Assault Program

The Marine Corps initiated a feasibility study in 1971 to develop a replacement for the LVTP7. In 1973 a Tentative Operational Requirement was established that identified the need for a high-speed (70 mph on water/55 mph on land) amphibious vehicle with an Initial Operational Capability (IOC) of 1986. This program became known as the Landing Vehicle Assault (LVA) program. After reviewing several alternatives to the high-speed amphibian program, the Marine Corps issued an Acquisition Decision Memorandum (ADM) in 1974 that identified the LVA as its highest priority.. The Major System Acquisition Review Committee (MSARC) approved the LVA in 1975 and Feasibility/Concept contracts were awarded shortly thereafter. The contracts were awarded to FMC Corp., Bell Aerospace Textron, and Pacific Car and Foundry. Work continued on the LVA for the next several years, with Conceptual Design contracts being awarded in 1976 to the same three companies and the continued development of components for high-speed amphibians. [Ref. 18]

In 1978, the Department of Defense (DoD) approved the Marine Corps' Amphibious Warfare Surface Assault (AWSA) Mission Element Need Statement (MENS) for the LVA. As directed by the Under Secretary of Defense for Research and Engineering, the Marine Corps conducted a Cost and Operational Effectiveness Analysis (COEA) on four alternatives identified in the AWSA MENS. They were the LVA (high water speed amphibian), the Landing Vehicle Tracked (Experimental) (LVT (X)) (low water speed amphibian), an Infantry Fighting Vehicle (IFV) (brought ashore on high-

speed landing craft), and an all helicopter-borne assault force. After reviewing the results of the concept studies for the LVA in 1979, the Commandant of the Marine Corps (CMC) cancelled the LVA program, citing concerns about vulnerability, affordability, and maintainability. With the concurrence of the Chief of Naval Operations (CNO), the CMC also cancelled the requirement for an Over-The-Horizon amphibious capability, stating that amphibious assaults can be launched under ten miles from shore. The LVT (X) was then chosen as the replacement for the LVA program.[Ref. 18]

6. The Landing Vehicle Tracked (Experimental) Program

The Landing Vehicle Tracked (Experimental) (LVT (X)) program had an IOC of 1986, so Conceptual Design contracts were awarded in 1978 to Booz-Allen & Hamilton, FMC Corp., Bell Aerospace Textron, and Advanced Technology, Inc. [Ref. 17:p. 3]. In December 1979, the CMC approved an interim Acquisition Strategy for the LVT (X) program, establishing an IOC of 1990. An approved Acquisition Strategy was not signed until 1983. In April 1982, the IOC was changed to 1994 in order to avoid any overlap with the LVTP7A1 SLEP. The IOC was changed again in 1983 to reflect a new IOC of 1997. In a span of four years, the IOC for the LVT (X) had slipped 11 years.[Ref. 18]

The MSARC Milestone I review, held over three sessions in 1984, was the turning point in the LVT (X) program. During the first session, three critical questions concerning the validity of the LVT (X) requirements were raised: [Ref. 17:p. 8]

1. In light of the development of new systems, such as the Light Armored Vehicle (LAV) and the Landing Craft Air Cushion (LCAC), did the Marine Corps still need an Amphibious Warfare Surface Assault (AWSA) capability?

2. If the Marine Corps still needed an AWSA capability, was the LVT (X) Required Operational Capability (ROC) still valid?

3. Did the Concept Design/Sustaining Engineering contractor design adequately fulfill the requirement?

After receiving answers to these questions, the MSARC recommended in October 1984 that the LVT (X) program strategy be approved, and Demonstration and Validation (D&V) contracts awarded. The CMC gave his approval in November 1984. [Ref. 17:pp. 8-30]

Despite receiving approval to enter the D&V phase, concerns about LVT (X) requirements persisted. In response to questions posed by the Secretary of the Navy (Research, Engineering, and Systems) in 1984 concerning the validity of the LVT (X) requirements, the CMC provided the following program alternatives and recommendations:[Ref. 18]

1. Continue LVT (X) program with IOC of 1998 (recommend disapproval).

2. Field only the LVT (X)P (troop-carrying variant) with an IOC of 1995 (recommend disapproval).

3. Institute the Advanced Assault Amphibian (AAAV) program (recommend approval).

After further review, the Secretary of the Navy (SecNav) cancelled the LVT(X) program in 1985. The SecNav determined that the marginal improvements in firepower and armor in the LVT (X) compared with the LVTP7A1 was not worth the estimated $9 billion cost of the new program. A ROC for the LVTP7A1 PIP was approved. More importantly, the AAAV program was designated as the new replacement vehicle for the LVTP7A1.[Ref. 18]

E. MODERN ERA OF AMPHIBIOUS OPERATIONS

During the mid-1970's, the Navy's primary role was sea control and convoy escort for the reinforcement role of Europe [Ref. 19:p. 23]. The Navy was a "blue-water" navy, focused primarily on countering the Soviet threat. Little emphasis was placed on the littorals and a surface-borne amphibious assault was seen as folly given the lethality of the weapons available at that time. In fact, during the late 1970's to the early 1980's initiatives were begun to "heavy-up" the Marine Corps to mirror existing Army divisions and move the Marine Corps away from its traditional amphibious role. Many believed a duplication of Army roles would lead to the future demise of the Marine Corps.

The Iranian hostage crisis in 1979 revealed significant weaknesses in the current doctrine with regard to the United States' ability to handle small-scale contingencies. As a result, the Carter Doctrine was developed in January of 1980 as a way to resolve the problems in the Arabian Gulf region. This was the first step in the path that led to the revalidation of a global military strategy for the United States. At that time, carrier battle

groups and amphibious ready groups were the only military assets capable of establishing U.S. presence in the Arabian Gulf region.[Ref. 19:pp. 23-24] The Department of the Navy's response to the changing world environment was to publish "The Maritime Strategy" in 1983. "The Maritime Strategy" addressed the role of Naval Forces in the execution of the National Military Strategy.[Ref. 19:p. 24]

1. Doctrine for Amphibious Operations Changes

In June1985, the Chief of Naval Operations (CNO) and the Commandant of the Marine Corps (CMC) published the "Amphibious Warfare Strategy" as a subset to "The Maritime Strategy". This new strategy outlined the employment of Navy-Marine Corps amphibious forces in support of the United States global national military strategy.[Ref. 19:pp. 24-25] The "Amphibious Warfare Strategy" stated that amphibious forces could be stationed Over-The-Horizon (OTH) at sea. [Ref. 19:p. 25] OTH meant launching the amphibious assault from 20 - 25 miles from the beach, as opposed to the previous doctrine of no more than 2.5 miles. This doctrinal change reflected the lethality that modern weapons would have on ships forced in close to shore to debark slow-moving assault landing craft.

This new strategy identified two new and then unfielded pieces of equipment, the Landing Craft, Air Cushion (LCAC) and the MV-22 tilt-rotor aircraft, as the new equipment that would be used to conduct these OTH operations. The LCAC and MV-22 were crucial because their high speed and long range provided the ability to operate from

OTH while still allowing for a more rapid closure to the beach.[Ref. 19:p. 28] Not surprisingly, there was no mention in this new strategy of the AAV, an improved AAV, or the AAAV. (It is interesting to note that when the "Amphibious Warfare Strategy" was published, the LCAC had not yet been fielded and its shortcomings – inability to conduct an amphibious assault across a defended beach due to its susceptibility to even small arms fire – had not been fully identified.) Finally, the "Amphibious Warfare Strategy" did recognize that doctrinal changes were required in order to fully implement the new over the horizon strategy: "The formation of an operational and tactical framework for amphibious operations from over the horizon is a high priority project." The best and the brightest officers in the Marine Corps were identified as working on the project.[Ref. 19:p. 28]

2. Equipment Changes Supporting the Over-The-Horizon Doctrine

During the mid-1980's the Marine Corps recognized that its aging equipment did not support the new OTH doctrine being developed. The AAV was too slow and had limited firepower and protection. The CH-46 Sea Knight helicopter had been fielded in the 1960's and was reaching the end of its service life. So, the Marine Corps began a modernization program that allowed Marine Air Ground Task Forces to become more lethal and mobile while still maintaining their amphibious character.[Ref. 19:p 20] The MV-22 was being developed as a replacement for the CH-46 while the AAV underwent a Service Life Extension Program (SLEP) to improve its mobility. At this same time,

fielding of the LCAC had begun and was revolutionizing ship-to-shore movement. Because of its high speed and payload capacity, the new LCAC caused many to question the need for a replacement amphibious vehicle.

The LVT (X) program was cancelled in June 1985 as a follow on to the existing AAV family. The lack of a credible amphibious assault vehicle that could replace the existing AAV and offer substantial improvement in performance, namely in higher water speed, provided an additional reason for LCAC supporters to question the Marine Corps' existing amphibious doctrine. Many felt that the "traditional concepts of an amphibious assault (were) obsolete" because of the "vulnerability of ships and slow moving landing craft to modern weapons systems."[Ref. 20:p. 80] The solution lay in a high-speed method of moving Marines from ship-to-shore. The cancellation of the LVT(X) program provided the impetus for many to express their ideas in professional journals on how to best accomplish this high-speed operation.

One idea, based on the capabilities of the LCAC, called for the "adoption of a smaller Air Cushion Vehicle (ACV) designed primarily to carry the AAV from ship-to-shore."[Ref. 20:pp. 22-23] The author felt that while AAVs were still intended to carry assault elements to the beach, they were too slow and too dependent on beach (tide and surf) conditions. Furthermore, the use of AAVs in conjunction with the LCAC would limit the future capability of the LCAC due to the AAVs slow speed. By using a new ACV to carry the AAV, the differences in speed would be overcome and would allow

them to work better together. At that time, the LCAC was slated to replace all other landing craft (LCM-8 and LCU) by mid 1990.

Another concept that was discussed was creating a new Landing Ship Fast (LSF) that would be designed to carry AAVs along with 150-200 Marines and their organic weapons [Ref. 22:p. 19]. The LSF would be capable of speeds up to 75 knots in order to make a high-speed approach to the beach to allow the AAVs to debark close to the shore. The LSF was to be based on technology being developed at the time for an inter-island vehicle and passenger ferry for use between the Hawaiian Islands.

Other articles called for using the LCAC to carry the existing AAV from ship-to-shore. However, this idea had its drawbacks as the LCAC only had the deck space to carry three AAVs at a time. Unfortunately, the payload capacity of the LCAC required that the AAVs not be fully fueled or manned with infantry Marines in order to conserve weight. This plan was not viable because the LCACs could not bring artillery and ammunition to shore immediately behind the assault Marines in order to quickly build up combat power ashore. Others even suggested that up to 250 Marines could be brought ashore in a single LCAC but recognized the difficulties in an amphibious assault without any armor protection.

Each of these ideas was studied but results were always the same: the Marine Corps needed a high-water speed assault vehicle capable of 20+ knots that could bring Marines quickly ashore. The new vehicle would also need to have improved cross-country mobility and the ability to keep up with the modern main battle tank, M1A1.

3. Beginnings of Advanced Amphibious Assault

The many problems associated with the LVT (X) program served as an invaluable source of lessons learned for other Marine Corps acquisition programs. One such problem area was program management. Initially, overall program management was the responsibility of the Naval Sea Systems Command (NAVSEA), who was designated as the Principal Decision Authority (PDA). This responsibility was a carryover from a charter signed between the Marine Corps and the Navy during the LVA program. The Commanding General, Marine Corps Development and Education Command (MCDEC) was responsible for developing the program. As a result of this divided responsibility, the LVT (X) Program Manager (PM) was assigned to NAVSEA but had two reporting chains. The PM reported to a Project Manager at NAVSEA and to the Director, Development Center at MCDEC. To make matters worse, no program charter had been developed. Clearly, this was not a good arrangement. Program oversight was difficult to maintain due to the number of military activities (12) and contractors (5) that program issues needed to be staffed through and coordinated. In an attempt to ease some of the program oversight problems, a memorandum of agreement (MOA) between MCDEC and NAVSEA was drafted in 1980 but never signed. The MOA established clear lines of authority and responsibility for the LVT (X) program.[Ref. 17:pp.10-11]

In June 1985, as the LVT (X) program was transitioning from the Concept Exploration phase to the D&V phase, the Marine Corps decided to take a more active role in managing the program. They established a Marine Corps AAV program office at

NAVSEA (PMS 310) and assigned a Marine Corps program manager, known as the Program Manager, Marine Corps Assault Amphibious Vehicles (PM-MCAAV), and a staff to manage AAV issues.[Ref. 17:p. 12]

When the LVT (X) program was cancelled in June 1985, the Marine Corps stated it still needed a replacement amphibious vehicle and assigned program management responsibility to PMS 310. The new vehicle was designated as the Advanced Amphibious Assault Vehicle (AAAV) but the program was not scheduled to begin until Fiscal Year 1991.[Ref. 23:p. 8]

Over the next two years PMS 310 fulfilled their tasking of further technological development in the area of high water speed for the AAAV. In 1986, as a result of taskings from PMS 310, the David Taylor Naval Research Center produced an Automotive Test Rig (ATR) and a ½ scale manned high water speed demonstrator. In 1987, a contract was awarded for a High Water Speed Technology Demonstrator (HWSTD) to AAI Corporation.

In December 1987 a Mission Area Analysis (MAA) was completed on ship-to-shore movement that identified significant operational deficiencies with the existing AAV7A1. These deficiencies covered the entire spectrum of capabilities necessary for an amphibious assault vehicle: offensive and defensive firepower, water speed, land speed, agility and mobility, armor protection and overall system survivability.[Ref. 24:p. 2] These deficiencies were identified by the Marine Corps in a Mission Need Statement (MNS) titled "Advanced Amphibious Assault" for a replacement to the AAV7A1 as part

of its 1990 - 1991 Program Objective Memorandum (POM) submission in 1988.[Ref. 24:p. 2] These deficiencies resulted in the Deputy Secretary of Defense signing a Program Decision Memorandum (PDM) on 14 July 1988 approving the Advanced Amphibious Assault (AAA) as a major new ACAT 1 (D) program. The Acquisition Decision Memorandum (ADM) was signed by the Under Secretary of Defense for Acquisition (USD (A)) on 19 August 1988. This signified the beginning of Phase 0 (Concept Exploration) of the program.

The MNS submitted by the Marine Corps offered three alternatives as replacements for the existing AAV7A1. The three alternatives were: a new high water speed amphibian, a new low water speed amphibian ferried ashore by a high-speed craft or sled, or an improved AAV7P1 (dubbed AAV7P2) ferried ashore by a high speed craft or sled.[Ref. 18:p.11] After reviewing these alternatives, the Defense Acquisition Board modified the MNS by tasking the Marine Corps to develop additional alternatives.

4. Establishment of the Program Management Office

In March 1990, the resources of PMS 310 were consolidated and moved from NAVSEA to the Marine Corps Research, Development, and Acquisition Command (MCRDAC) (CBAV). The PM-MCAAV was redesignated the Direct Reporting Program Manager for Advanced Amphibious Assault (DRPM AAA). The new reporting chain was much more streamlined than before. The DRPM AAA now reported directly to the Assistant Secretary of the Navy (Research, Development, and Acquisition (ASN(RDA)),

who is the Navy Acquisition Executive (NAE). The DRPM AAA Charter was signed by ASN (RD&A) in August 1990.[Ref. 6:pp. 1-4]

The Charter assigned the DRPM AAA responsibility for all current and future AAV programs, to include advanced development, production, modernization, conversion, and life cycle technical support. The DRPM AAA was tasked with developing a program:

> intended to design, develop, and field a cost-effective, state of the art system of AAAV's to replace the existing AAV7A1 series of amphibians. The AAAV will be a high water speed amphibian vehicle capable of independent operations in water and on land. It will provide one of the principal means of tactical surface mobility, armored protection, and offensive firepower for the landing force during both the ship-to-shore phase of amphibious operations and subsequent combat operations ashore. [Ref. 24]

Additionally, the charter mandated that the DRPM, AAA be collocated with MCRDAC "to ensure an optimum working relationship [Ref. 6:p. 5]." The charter also identified AAA as the Marine Corps number one ground priority. At the time the Charter was signed, the AAA program consisted of the following five Program Elements [Ref. 6]:

1. Assault Amphibious Vehicles (AAV7A1 family)
2. AAV Product Improvements (AAV7A1 PIP)
3. Advanced Amphibious Assault (AAA)
4. Stratified Charged Rotary Engine (SCRE)
5. Marine Corps Assault Vehicles (Engineering)

The DRPM AAA remained responsible for all AAV programs until June 1993, when the AAAV and AAV programs were functionally separated. The AAV and related programs were transferred from DRPM AAA to the Commander, Marine Corps Systems Command (COMMARCORSYSCOM).[Ref. 25] COMMARCORSYSCOM was now responsible for maintaining the AAV until the AAAV was fielded. DRPM AAA could now focus all of his energies on successfully fielding the AAAV.

5. Amphibious Doctrine in the 1990's

In September 1992, the Department of the Navy published its White Paper "...From the Sea: A New Direction for the Naval Services" outlining a new vision for the Navy and Marine Corps.[Ref. 26:p. 19] "...From the Sea" defined the Navy's new strategy as one that has shifted "from a focus on global threat to a focus on regional challenges and opportunities." This strategic direction, derived from the National Security Strategy, represents a fundamental shift away from open ocean warfighting *on* the sea toward joint operations conducted *from* the sea.[Ref. 26:p.19] This strategic concept was designed to carry the Navy beyond the Cold War and into the 21st Century [Ref. 27:p. 32]. One of the fundamental tenants of "...From the Sea" involves power projection. Naval forces maneuver from the sea using their dominance of littoral areas to mass forces rapidly and generate high-intensity, precise offensive power at the time and location of their choosing, under any weather conditions, day or night.[Ref. 26:p.21] The final statement of "...From the Sea" is that the Navy and Marine Corps will "procure

equipment systems to support this strategy and remain ahead of the global technological revolution in military systems."[Ref. 26:p. 22] The implication for the Marine Corps is that this new strategy wholeheartedly supports the procurement of the AAAV and the MV-22.

Two years later, in October of 1994, "...From the Sea" was updated with "Forward...From the Sea". While it did not signal any doctrinal changes, this latest White Paper reaffirmed the Navy's commitment to operations in the littorals. Though not explicitly stated, both white papers outline a strategy that is dependent on the capabilities that will be provided by the AAAV. Without a high water speed amphibious assault vehicle, the Navy and Marine Corps will be limited in their ability to project power ashore quickly.

The strategy that does explicitly mention the AAAV is "Operational Maneuver From The Sea (OMFTS)" which was published in January 1996. OMFTS builds on "...From the Sea" and "Forward...From the Sea" and describes how the Navy and Marine Corps will combine naval and maneuver warfare and to achieve decisive objectives through ship-to-objective maneuver (STOM). OMFTS is dependent on the ability of the Navy and Marine Corps to "sea-base" its command and control, logistics and the majority of fire support assets. Sea-basing will facilitate "putting the "teeth" ashore while leaving the logistics "tail" afloat, significantly leveraging land maneuver operations."[Ref. 28] In order to accomplish OMFTS, the Marine Corps will need assets that are able to leave the "sea-base", most likely loitering over-the-horizon, and reach the beach quickly. OMFTS

identifies three key platforms that are required to bring the concept to reality: the MV-22 Osprey, the LCAC, and the AAAV."[Ref. 28]

F. SUMMARY

This chapter has outlined the history of the doctrine and equipment the Marine Corps has used in executing amphibious operations. Beginning in the 1930's with a rough concept on how to conduct amphibious assaults and the Higgins Boat, the Marine Corps developed doctrine and the venerable "amtrac" that ensured the success in the Pacific Island hopping campaign of World War II. Since then, the Marine Corps has continually honed and developed both the doctrine and the equipment itself. The Marine Corps continued developing the doctrine and trying to improve on the equipment, even when many felt that the idea of conducting an amphibious assault was insane, given the lethality of modern weapons and the slow water speed of the amtrac. Now, the Marine Corps has entered into the latest era of amphibious operations. This era will be marked by over-the-horizon operations conducted by the most technologically advanced assault amphibian the Marine Corps has ever seen: the Advanced Amphibious Assault Vehicle.

The next chapter will present the contracting history of the AAAV program, the contracting organizations that support it, the contract types used and the unique contract clauses used during the Concept Demonstration and Validation phase.

III. CONTRACTING PROCESS

A. INTRODUCTION

The success of any Major Defense Acquisition Program (MDAP) is a result of many factors: politics, organizations, people, and processes. The contracting process is one vehicle that ties all of the factors together. Politicians may cancel a MDAP developing a necessary weapon system due to a controversy such as a cost overrun. Organizational priorities change and may cause a MDAP to be cancelled or significantly changed.[Ref. 1:p. 15] Inexperienced people in the Program Management Office (PMO) may make mistakes that jeopardize a program. Finally, the acquisition process itself, with its oversight and reviews, can cause a much-needed system to be canceled or the program delayed.

The contract is the link between the Government and the contractor and the means by which the system requirements are expressed. Without a clearly defined, well-written and adequately managed contract, the PMO can experience difficulties and problems that can significantly jeopardize the success of the program. This chapter examines the contracting history and the contracting process itself as it has been used within the Advanced Amphibious Assault Vehicle (AAAV) program. It will also examine the organizations that have played a role in the AAAV program. Next, this chapter addresses the contract types available for use and actually used at the AAAV program. Finally, the

chapter describes the unique contract clauses that have been used in the AAAV Concept Demonstration/Validation (CD/V) contract. The Concept Demonstration/Validation phase is now known as the Program Definition and Risk Reduction (PDRR) but will be referred to hereafter as the CD/V phase.

B. CONTRACTING HISTORY

The current AAAV program formally began with the approval of Milestone 0 in the Program Decision Memorandum (PDM) published in July 1988. The Acquisition Decision Memorandum (ADM) published the following month directed the Marine Corps to "examine alternatives of placing infantry ashore, not just a new amphibious vehicle." The program was given the official name Program Manager, Advanced Amphibious Assault (PM, AAA). This name was intended to reflect the program's pursuit for a solution to the ship-to-shore portion of the new over-the-horizon (OTH) doctrinal concept from a number of proposed ideas, not a solution limited only to an amphibious vehicle.

1. Technology Base Development Program

Numerous efforts had been undertaken before Milestone 0 approval to help develop the technology necessary to design and build the new high-water speed amphibious assault vehicle. In 1985, a Technology Base Development Program was initiated by the Amphibious Warfare Technology Directorate (AWT) at the Marine Corps Research, Development and Acquisition Command (MCRDAC).[Ref. 5] The Marine Corps Programs office at the David Taylor Research Center (DTRC) located in Bethesda,

Maryland executed the research and development effort. The technology development was intended to help show that the high-water speed amphibian was possible while at the same targeting the high "drivers" of affordability, risk and performance.[Ref. 29]

a. Automotive Test Rig

The Automotive Test Rig (ATR) was the first step in the DTRC's quest to prove that a high-water speed amphibian was possible. But this was not DTRC's first exposure to a high-water speed assault amphibian. They had worked on the LVA program in the 1970s and had developed an idea of what the future AAAV would look like. So they began by "reverse engineering" the AAAV and began projects that reduced the vehicle weight; developed a retractable hydropneumatic suspension; and the first "drive-by-wire" system for a combat vehicle. [Ref. 30]

A Cost-Plus-Fixed-Fee (CPFF) contract was competitively awarded to AAI Corporation to produce the ATR [Ref. 30]. The ATR was a ½ scale, 14 ton, manned vehicle that was used to prove the feasibility of the automotive components needed by the AAAV before they were included into the next phase of the Technology Base Development Program.[Ref. 31:p. 37]

b. High Water Speed Technology Demonstrator

The AAI Corporation was competitively awarded the follow-on contract by DTRC to produce the High-Water Speed Technology Demonstrator (HWSTD) in 1987. [Ref. 30] Again, a CPFF contract was used for this phase of the technology base

development program.[Ref. 30] The HWSTD was the next logical step up from the ATR. Weighing in at 16 tons, the HWSTD was .75 scale and incorporated many of the improved components and subsystems of the ATR.[Ref. 5:p. 2] The HWSTD also introduced a bowflap, track covers and a transom flap with integrated water jets developed in-house by DTRC.[Ref. 31:p. 37] The HWSTD was tested extensively from December 1989 through the first quarter of 1990 at the David Taylor Surface Effects Ship Support Office (SESSO) at Patuxent, Maryland. During testing the HWSTD achieved water speeds of 33 miles per hour.[Ref. 18]

c. Propulsion System Demonstrator

The Propulsion System Demonstrator (PSD), a .9 scale, 30 ton armored amphibious vehicle, was the final step in the technology base development program by DTRC. The contract for the PSD was a competitively awarded CPFF contract that again went to the AAI Corporation.[Ref. 30] The objective of the PSD was to "demonstrate the feasibility of attaining 20 plus miles per hour over water speed in a full scale troop carrying vehicle."[Ref. 32] While the ATR and the HWSTD demonstrated automotive and waterborne capabilities, they were not capable of carrying personnel, other than the driver and an evaluator. Nor were they armored. The PSD, on the other hand, carried a crew of three along with sixteen troops.[Ref. 32]

The PSD was tested at DTRC's SESSO on the Patuxent River in the Fall of 1991 through March 1992 where it achieved a top water speed of 28.7 knots.[Ref. 5:p.

2] During the testing period a demonstration of the PSD was also held on the Potomac River, near the Washington Monument, on February 12, 1992. In attendance at this demonstration were numerous influential people from the office of the Under Secretary of Defense (Acquisition) (USD(A)) as well as the Department of the Navy. Attendees included the Head of the Conventional Systems Committee (USD(A)), Mr. Kendall; the Director of Land Warfare (USD(A)), Mr. Viilu; the Director of Naval Warfare (USD(A)), Mr. Martin; the Assistant Secretary of the Navy for Research Development and Acquisition (ASN(RDA)), Mr. Cann; the Commandant of the Marine Corps, General Mundy; and several other General Officers. During two demonstrations held on that day, the PSD successfully demonstrated its maneuverability and high speed capabilities before demonstrating its ability to reconfigure itself from a sea-mode to land-mode. Following the high-water speed demonstration on the Potomac, it drove up the ramp at the Bolling Air Force Base yacht basin where the observers got a first-hand look at the PSD.[Ref. 33] This successful demonstration helped prove that the concept of a high-water speed assault amphibian was indeed possible.

2. Concept Exploration Contracts

The Concept Exploration (CE) Phase of the AAAV program can be divided into two parts. The first part was to define the problem and explore different alternatives while the second part was to exploit the knowledge gained during the Technology Base Development Program and use it to reduce the risk of the preferred alternative selected.

The high-water speed approach was determined to be technically feasible as a result of the progress being made in the Technology Base Development Program.[Ref. 5:p. 2] However, it was realized that there were differing technical approaches, such as AAI's planing-hull technology or FMC Corporation's hydrofoil-assisted planing-hull, that could be taken to satisfy the necessary performance requirements.[Ref. 5:p. 2]

a. Part One

The problem that was tackled during this part of the CE phase was centered around the AAAV system mission. The first set of contracts was awarded to FMC and General Dynamics Land Systems (GDLS) in February and April 1990 respectively.[Ref. 5:p. 2] These first contracts were Firm-Fixed-Price (FFP) and were awarded for $1.5 million each. The contracts were awarded by the NAVSEA contracting officer supporting PMS-310.

The purpose of the first set of contracts was to gain industry input into the different technical approaches and cost uncertainties.[Ref. 5:p. 2] Under these first study contracts, FMS and GDLS were each tasked with developing concept designs; cost estimates, development plans, tow tank test models of their proposed design, armor samples, and a full-scale mock-up.[Ref. 34]

The existing requirement to award a cost-type contract for this research effort did not apply to these contracts for two reasons. First, they were less than $10 million threshold at the time for mandatory cost-type contracts.[Ref. 35] Second, a fair

and reasonable price was established by the Government based on historical cost data for this type of study. [Ref. 36: p. B-13]

As the CE Phase progressed, the initial Cost and Operational Effectiveness Analysis (COEA) was completed in March 1991.[Ref. 29] The COEA evaluated 13 different alternatives that included high-water speed amphibians, low-water speed amphibians, non-amphibians (i.e. armored personnel carriers, infantry fighting vehicles) and non-vehicles (i.e. all air via helicopters or all surface via LCAC).[Ref. 29] The results of the COEA clearly showed that a self-deploying high-water speed amphibian (the AAAV) was the overall superior choice by a considerable margin.[Ref. 37] Additionally, the AAAV alternative was found not to be the most expensive alternative as many had expected.[Ref. 37]

b. Part Two

A Marine Corps Program Decision Meeting (MCPDM), chaired by the ASN(RDA), Mr. Cann, was conducted on 11 April 1991. The MCPDM was held in preparation for the Defense Acquisition Board (DAB) Milestone I review of the program on 29 May 1991. The result of the MCPDM was that ASN(RDA) required that an independent technical assessment of the program be conducted prior to moving further through the Milestone I DAB process, due to the perceived technical risks associated with the new AAAV.[Ref. 38:p. 1]

The ASN(RDA) tasked the Office of Naval Research's (ONR) Office of Advanced Technology (OAT) to conduct an independent "Red Team" assessment of FMC's and GDLS's AAAV designs and the program.[Ref. 38:p. 1] The Red Team assessment, completed in July 1991, identified three chief areas of technical risk regarding the two competing contractors designs and made seven recommendations for mitigating or eliminating the risk.[Ref. 38:p. 1]

Following the "Red Team" assessment, the DRPM, AAA awarded FMC and GDLS follow-on contracts that focused on conducting technical risk reducing experiments.[Ref. 38:p. 1] The follow-on CPFF contracts were awarded in September 1991. Since these contracts were not competitively awarded, a class Justification and Approval (J&A) was approved by ASN(RDA).[Ref. 39] The MCRDAC Contracting Officer supporting the AAAV program awarded these contracts. These contracts included the fabrication and testing of near-full scale hydrodynamic test rigs of the contractor's own design and numerous other activities focused on all areas of technical risk.[Ref. 38:p. 1]

In 1992, ONR held a second "Red Team" technical assessment which was completed in November 1992.[Ref. 29] This assessment evaluated the contractors' new AAAV designs and the results of their technical risk reducing activities.[Ref. 38:p. 2] The assessment included the following findings and recommendations:[Ref. 29]

- The risk reducing initiatives and action taken by the AAAV Program Office since the ONR July 1991 technical assessment have resulted in the elimination of high risk areas in both the FMC and GDLS baseline concepts for the AAAV.

- Initiate full-scale prototype design, development and testing.

The final set of CE contracts was awarded to GDLS and FMC in July 1993. These non-competitive follow-on contracts were CPFF contracts awarded by MCRDAC. The purpose of the contracts was to have both contractors continue with their technical risk reducing activities and to build and test full-scale automotive test rigs.

In December 1994, the Office of the Secretary of Defense (OSD) issued Program Decision Memorandum 4 (PDM-4). This decision took $190 million in funding away from the AAAV Program during Fiscal Year (FY) 1996 through FY 2001.[Ref. 40] No contractual actions, such as contract repricing or descoping, were required as a result of this funding decrease. [Ref. 35] However, PDM-4 did increase the period of the Concept Demonstration and Validation (CD/V) phase of the program by over two additional years to 72 months. [Ref. 40]

3. Concept Demonstration and Validation Contract

The AAAV Program was approved by the DAB on 15 March 1995 and the ADM was signed on 17 March 1995 giving Milestone I approval and allowing the program to enter into the CD/V phase of the program. Because of the substantial effort made to reduce the technical risk of the program and the similarity of the two contractors' designs,

the decision was made to go ahead and down-select to one contractor during CD/V instead of at least two as had been planned in the Acquisition Strategy.[Ref. 7]

The Request for Proposal (RFP) was issued on June 30, 1995 requesting submission of "detailed technical, management and cost proposals for the design and development of AAAV prototypes and associated engineering and development efforts during the CD/V phase of the AAAV program".[Ref. 41:p. 1] Competition was limited to GDLS and United Defense Limited Partnership (UDLP) (formerly known as FMC), the two companies that had participated with the CE phase development of the AAAV. Both offerors submitted their initial Technical/Management Proposals on 29 September 1995 and detailed cost proposals on 16 October 1995. From 9 September through 22 December 1995 the Source Selection Evaluation Board (SSEB) evaluated each proposal in accordance with detailed, pre-determined evaluation standards for each factor/sub-factor.[Ref. 41:p. 2]

In October 1995, PDM-2 was issued restoring $107 million of the $190 million reduced FY-96 through FY-01 funding stream caused by PDM-4. The increased funding caused a reduction in the CD/V phase from a 72-month performance period to only 62 months.[Ref. 41:p. 3] As a result of the acceleration of the period of performance and numerous exceptions in both proposals to the terms and conditions of the solicitation, an amendment to the RFP was issued on 14 December 1995.[Ref. 41:pg. 3] The amendment provided significant additional instructions to the offerors regarding cost information to

be provided with their revised proposals in order to clarify problems encountered in the initial cost evaluation.[Ref. 41:p. 3]

Both GDLS and UDLP responded to the amended RFP with new cost proposals. These new proposals were both determined by the PCO and PM to have total estimated costs significantly below that which the Government believed to be reasonably necessary to successfully complete the required effort during CD/V.[Ref. 42] According to the PM, contractor "buy-in", and not having a process in place to catch it, was a primary concern. [Ref. 7] The FAR defines "buying-in" as [Ref. 43:part 3.501-1]:

> ...submitting an offer below anticipated costs expecting to increase the contract amount after award (e.g., through unnecessary or excessively priced change orders) or to receive follow-on contracts at artificially high prices to recover losses incurred on the buy-in contract.

The PM was concerned about contractor buy-in because of the detrimental effect cost overruns would have on the program and the fact that the Marine Corps, with its limited budget, would not have the fiscal resources or flexibility to recover.[Ref. 7]

The PM made the decision to show GDLS and UDLP that their technical proposals did not match their cost proposals. He did this by providing each of the offerors a Government cost estimate based on their own technical proposal which showed they both had significantly underestimated their cost of performance.[Ref. 7] Finally, the PM challenged the two contractors to either prove that the Government estimates were wrong or to increase their proposed cost in their Best And Final Offer (BAFO). As a result of this challenge, both offerors increased their proposed price approximately $40

million on their BAFO.[Ref. 7] The source selection evaluation process was completed and the Source Selection Advisory Council (SSAC) report was issued to the Source Selection Authority (SSA) on June 10, 1996.[Ref. 41:p. 1] The SSAC recommended that GDLS be selected due to their technically superior proposal which was significantly less cost than UDLP's.[Ref. 41:p. 7] The CD/V contract was awarded to GDLS on June 13, 1996. [Ref. 44]

C. CONTRACTING ORGANIZATION

The contracts in support of the AAAV Program have been awarded by several different organizations. The contracts that supported the Technology Base Development Program from 1985 through 1992 were awarded by DTRC.[Ref. 30] Contracts awarded during the CE phase while the AAAV program belonged to PMS-310 at Naval Sea Systems Command (NAVSEA) were awarded by the NAVSEA contracting officer matrixed to support the AAAV program.[Ref. 45] Contracts in support of engine development within the United States at John Deere, Incorporated, were awarded by NAVSEA while contracts for engine development in Germany at the Motorine Turbine Union (MTU) were awarded by the Naval Regional Contracting Center (NRCC) Naples, Detachment London. After the PM, AAA moved from NAVSEA to MCRDAC in 1990, overall responsibility for contracting moved to MCRDAC as well.[Ref. 6]

The only Defense Contract Management Command (DCMC) involvement with the AAAV related contracts during the Technology Base Development Program or the

the CE phase was with the three sets of CE contracts.[Ref. 8 and Ref. 30] Contract administration was provided by DCMC personnel at the FMC facility in San Jose, California and by DCMC personnel at the GDLS facility in Sterling Heights, Michigan. [Ref. 8]

The CD/V contract was awarded by the AAAV Procuring Contracting Officer (PCO) matrixed from the Marine Corps Systems Command (MARCORSYSCOM) in Quantico, Virginia. In addition to the PCO, there are two other sections which are involved in managing the CD/V contract: the Administrative Contracting Officer (ACO) and a Contracts Management section within the AAAV Program Management Office (PMO).

1. The Administrative Contracting Officer

The Administrative Contracting Officer (ACO) is collocated with the AAAV PMO and is matrixed from DCMC Manassas, Virginia. The ACO serves as the primary DCMC interface with the PCO.[Ref. 46:p. 5] One Procurement Technician assists the ACO. [Ref. 46:p. 8] The two of them are members of the DCMC Program Support Team (PST) consisting of a total of eight DCMC personnel assigned to support the AAAV program.[Ref. 46:p.10]

A Memorandum of Agreement (MOA) was signed on August 26, 1997, outlining the relationship between the AAAV PMO and the DCMC PST.[Ref. 46:p. 1] The following responsibilities of the ACO are listed in the MOA: [Ref. 46:p. 5]

1. Provides pricing support to the PCO negotiations and execute contractual documents for settlement of efforts delegated to the ACO by the PCO for definitization.

2. Serve as the primary interface with GDLS Divisional Administrative Contracting Officer (DACO) and General Dynamics Defense Corporate Executive (DCE). Apprise the PCO and Contract Manager of corporate and GDLS issues, especially if the issues impact rates/proposal estimates. Verify GDAMS Forward Pricing Rate Agreement (FPRA) or Forward Pricing Rate Recommendation (FPRR) prior to concurrent pricing arrangement on contract changes/additional contract work.

3. Request Defense Contract Audit Agency (DCAA) support as needed.

4. Participate in concurrent pricing activities within the IPT structure, as required.

5. Support the DRPM Office estimating and budgeting, when requested, by reviewing contractor rate data and interface with DCAA.

6. Execute Single Process Initiative contract modifications.

7. Support the DRPM Contract Manager and the PCO on major contracting issues as appropriate.

8. Provide Award Fee inputs, as required.

9. Participate in milestone reviews and program reviews, as required.

10. Support the DRPM Business and Financial Management Office primarily in the areas of expenditures.

2. Contract Management Section

The AAAV PMO is organized around seven functional directorates (see organizational chart shown in Appendix B) which comprise the Program Management Team (PMT) supporting the Program Manager. One of the seven elements is the Contract Manager.

The Contract Manager is responsible for contract activities directly related to the CD/V contract performance to include Earned Value Management; cost estimating and analysis; performance terms and conditions; and interaction with the DCMC PST. [Ref. 35] The specific duties and responsibilities of the Contract Manager as defined by the PM are shown in Appendix C. A Procurement Analyst and a Cost Performance Analyst assist the Contract Manager. Both the Contract Manager and the Procurement Analyst billets are trained contract specialists (General Series 1102).[Ref. 47]

D. CONTRACT TYPES

The AAAV Program has used both fixed-price and cost-reimbursement contract types to acquire goods and services. This portion of this chapter will explain the contract types most commonly used by the AAAV Program and describe when they were used.

1. Firm-Fixed-Price Contracts

A Firm-Fixed-Price (FFP) contract is used when the risk involved is minimal or can be reasonably predicted.[Ref. 1:p. 73] In an FFP contract, the Government (the buyer) and the contractor (the seller) agree to a price for the item or service before the contract is awarded and that price remains in effect for the duration of the contract. [Ref. 1:p. 77] The contractor accepts full cost responsibility with an FFP contract and is rewarded with greater profit if its costs are controlled. At the same time, an FFP contract requires only minimal administrative oversight by the Government.[Ref. 48:p. 4-14] An

FFP contract is best suited for a situation where there are clear specifications and the price can be realistically determined beforehand.[Ref. 48:p. 4-19]

Within the AAAV Program FFP contracts have only been used five times. During the Technology Base Development Program only one FFP contract was used to procure a component.[Ref. 30] Firm-Fixed-Price contracts were used during the CE Phase for the first set of exploratory contracts awarded to FMC and GDLS.[Ref. 49] Finally, two of the engine development contracts with the Motorine Turbine Union (MTU) awarded by NRCC Naples, Detachment London were FFP.[Ref. 49]

2. Cost-Reimbursement Contracts

A cost-reimbursement type contract is used when the costs associated with contract performance are uncertain and cannot be reasonably estimated.[Ref. 48:p. 4-18] A cost-reimbursement contract can be used under the following conditions:[Ref. 48:p. 4-18]

1. The contractor's accounting system is adequate for determining costs applicable to the contract.

2. Appropriate surveillance by Government personnel during contract performance can be maintained to give reasonable assurance that inefficient or wasteful methods are not being used.

3. It can be shown that a cost-reimbursement contract is less costly than another type of contract and also that the subject of the procurement could not practically be obtained without using such a contract.

4. Statutory limits on price or fee are taken into account.

Cost-reimbursement type contracts reimburse the contractor for all of their reasonable, allowable, and allocable costs incurred during the performance of the contract and then pay them a fee or profit.[Ref. 1:p. 81] There are several different types of cost-reimbursement type contracts available to the contracting officer. The most commonly used cost-reimbursement contract is the Cost-Plus-Fixed-Fee (CPFF) contract.[Ref. 48:p. 4-21] The CPFF contract has also been the most commonly used contract type in support of the AAAV program.

a. Cost-Plus-Fixed-Fee Contract

According to the FAR, a cost-plus-fixed-fee contract is a [Ref. 43: part 16.306]:

> ...cost-reimbursement contract that provides for payment to the contractor of a negotiated fee that is fixed at the inception of the contract. The fixed fee does not vary with actual cost, but may be adjusted as a result of changes in the work to be performed under the contract. This contract type permits contracting for efforts that might otherwise present too great a risk to contractors, but it provides the contractor only a minimum incentive to control costs.

The CPFF is typically used during the developmental phases of an MDAP because of the uncertainty that lies within the program, especially one that is facing technological challenges.[Ref. 1:p. 81] The primary reason a CPFF contract is used here is that, in order to compensate for the cost uncertainties borne by the contractor, all of the cost responsibility falls on the Government. The downside of the CPFF contract type to the Government is that the contractor has virtually no incentive to control costs since he

will be getting his costs covered plus a set, fixed fee. According to FAR Part 16.306, the fixed-fee could be up to fifteen percent of the initially contracted costs for a development contract. A CPFF contract should not be used in a program once concept exploration indicates that engineering development is now feasible.[Ref. 1:p. 76] At this stage of a program, another contract type, such as an incentive-type contract like a cost-plus-award-fee (CPAF) or cost-plus-incentive-fee (CPIF) contract, may be more suitable.

b. Cost-Plus-Award-Fee Contract

A Cost-Plus-Award-Fee (CPAF) contract was chosen for the Concept Demonstration/Validation (CD/V) Phase of the AAAV program. The FAR describes CPAF contracts as [Ref. 43:part 16.405-2]:

> ...cost-reimbursement contract that provides for a fee consisting of a base amount fixed at inception of the contract and an award amount that the contractor may earn in whole or in part during performance and that is sufficient to provide motivation for excellence in such areas as quality, timeliness, technical ingenuity, and cost-effective management. The amount of the award fee to be paid is determined by the Government's judgmental evaluation of the contractor's performance in terms of the criteria stated in the contract. This determination is made unilaterally by the Government and is not subject to the Disputes clause.

The FAR states the CPAF contract is most suitable for use when [Ref. 43: part 16.405-2(b)(1)(ii)]:

> ...the likelihood of meeting acquisition objectives will be enhanced by using a contract that effectively motivates the contractor toward exceptional performance and provides the Government with the flexibility to evaluate both actual performance and the conditions under which it was achieved.

The FAR goes on to state that the CPFF contracts should only be used when the "additional administrative effort and cost required to monitor and evaluate performance are justified by the expected benefits." [Ref. 43:part 16]

A CPAF contract will have contractor evaluations performed at stated intervals throughout the contract period. This ensures that the contractor is periodically informed of the quality of its performance and can take corrective action, if necessary, to improve performance where required. Payment of the award fee coincides with the performance during each evaluation period. This incentivizes the contractor by rewarding outstanding performance through payment of the award fee and penalizing average or substandard performance through non-payment of the award fee for that period.

Until recent legislation removed this restriction, CPAF contract award fees were subject to the same fee limitations as the CPFF contract. For this type of MDAP, the maximum base fee plus award fee could not exceed fifteen percent of the contract costs. The base fee still cannot exceed three percent of the total estimated cost.[Ref. 43:part 15.903(d)(1)(i) and Ref. 50:part 216.404-2(c)(ii)(2)(b)] An Award Fee Review Board (AFRB) conducts the evaluation of the contractor's performance. The AFRB reviews the contractor's performance during each evaluation period and makes a recommendation to the Fee Determination Official (FDO) of the resulting award fee amount. The FDO has the final say as to how much, if any, award fee to award the contractor each period. Finally, the FDO's decision is not subject to the Disputes Clause of a contract. This means that the FDO's decision is final and the contractor knows that he must meet the

standards as outlined in the Award Fee plan. The FDO for the AAAV Program is the Program Manager.[Ref. 7]

E. CONTRACT CLAUSES

In addition to the body of the contract which is written to explain what work the Government expects the contractor to perform there are a number of clauses mandating the contractor to abide by additional requirements. FAR part 52.101 defines a contract clause as "a term or condition used in contracts or in both solicitations and contracts, and applying after contract award or both before and after award." The AAAV CD/V contract had several unique clauses in both the solicitation and in the contract awarded to GDLS. These unique clauses called for a specific geographic location of the GDLS facility; collocation of the AAAV PMO with the contractor; the use of Integrated Product and Process Development (IPPD) and Integrated Product Teams (IPTs); cost sharing with GDLS; and a special provision regarding AAAV system design decisions. These unique clauses are addressed in the following sections.

1. Location/Collocation

The Request For Proposal (RFP) for the Concept Demonstration/Validation (CD/V) contract required the contractor to locate their research and development facility "within 20 minutes by car of Springfield, Virginia, the intersection of Interstate 95, 395 and 495." [Ref. 51] The contractor was further required to have all key personnel (listed in the Key Personnel clause of the contract) located at this facility full time. [Ref. 51]

Finally, the contractor was required to provide the AAAV PMO with office space (including offices, spaces, furniture and equipment) collocated at the contractor's facility. [Ref. 51] This is the first time that a Major Defense Acquisition Program (MDAP) has been completely collocated with the prime contractor and its major subcontractors.[Ref. 52]

This geographic location was chosen for several reasons. First, it was conveniently located to both Washington, D.C., and Quantico, Virginia. Being close to Washington was advantageous because of the frequent interaction that is required with the various Department of Defense, Department of the Navy, and congressional staffs. Being close to Quantico was advantageous because of the various Marine Corps activities, such as the Marine Corps Systems Command and the Marine Corps Combat Development Command, that are located there. Another benefit of being close to Quantico is that there is a platoon of AAV7A1s located at The Basic School, providing the AAAV PMO with a ready pool of enlisted Marines with amphibious vehicle expertise to participate in the user testing required during the CD/V phase. The second reason that the PM wanted to specify this geographic location is that it required either offeror, GDLS or UDLP, to relocate to a new facility away from their corporate headquarters.[Ref. 7] The new location would become "neutral ground" for everyone involved on both sides of the AAAV project.[Ref. 7] This move was necessary to help create a "cultural change" that the PM envisioned.[Ref. 7] This cultural change would come about through

collocation and the use of an Integrated Product and Process Development (IPPD) process with Integrated Product Teams (IPTs).

The Government had developed a unique technical knowledge of high-water speed amphibians as a result of its involvement in the canceled LVA program and the successful Technology Base Development Program.[Ref. 7] By collocating, the Government would be better able to impart that knowledge to the contractor. An additional benefit was that through the daily interaction that was inevitable with collocation, the Government wanted the contractor to get to know their "customer", the Marine Corps, better.[Ref. 7] The PM felt that by having the GDLS employees "observe what Marines are all about" and being "exposed to the Marine Corps culture" they would "gain a clear understanding of who Marines are" and design a better AAAV.[Ref. 7]

The PM began a program to educate the contractor on the operating environment; vehicle uses; problems and strengths of the existing AAV7A1; U.S. Marine Corps amphibious doctrine; and amphibious warfighting scenarios.[Ref. 52] He took all of the GDLS employees, and the civilian Government employees, to Norfolk, Virginia, where they spent a night aboard an amphibious ship in the same berthing areas that enlisted Marines would sleep. The next morning, they conducted a mock amphibious landing using AAV7A1s and were able to drive them on the beach if they desired. According to the GDLS contracts manager, this was the first time in over 20 years of experience with the Government that he was able to do anything like this.[Ref. 53] On another occasion the PM had a Marine Corps corporal who had almost drowned in an incident where an

AAV7A1 sank, speak about the experience to the GDLS employees.[Ref. 7] These experiences gave the GDLS employees a unique perspective on the performance requirements of the system they were designing and building.[Ref. 53] The PM also had the GDLS employees attend a Marine Corps live-fire demonstration in Quantico so that they could see actual combat weapons being used. The PM invited the GDLS employees to a Marine Corps Mess Night so they could experience first-hand the camaraderie of the Marines.[Ref. 7] Finally, the Marine Officers in the AAAV PMO gave classes on Marine Corps leadership principles to the GDLS employees. These classes were especially useful for the newly appointed IPT leaders.

2. Teaming

One of the benefits of collocation is that it facilitates the use of IPPD and IPTs. The CD/V contract requires that the Government and the contractor agree to "utilize an Integrated Product and Process Development (IPPD) approach including the concept of 'TEAMING' in managing the program." [Ref. 54:p. H-24] Integrated Product and Process Development is defined by as [Ref. 55]:

> ...a management technique that integrates all acquisition activities starting with requirements definition through production, fielding/deployment and operational support in order to optimize the design, manufacturing, business, and supportability processes. At the core of IPPD implementation are Integrated Product Teams (IPTs).

The DOD 5000.1 also directs program managers to use the concept of IPPD throughout the acquisition process to the maximum extent practicable.

The contract also requires that at a minimum the contractor "shall have an IPT that corresponds to each second level element of the vehicle Work Breakdown Structure (WBS)."[Ref. 54] The Integrated Product Team (IPT) is described as [Ref. 55]:

> ...composed of representatives from all appropriate functional disciplines working together with a Team Leader to build successful and balanced programs, identify and resolve issues, and make sound and timely recommendations to facilitate decision-making. There are three types of IPTs: Overarching IPTs focus on strategic guidance, program assessment, and issue resolution. Working Level IPTs identify and resolve program issues, determine program status, and seek opportunities for acquisition reform. Program IPTs focus on program execution, and may include representatives from both Government, and after contract award, industry.

The AAAV program uses 28 IPTs (shown in Appendix D) broken down into four levels: "A" through "D". The one "A" level IPT, the AAAV System IPT, is the highest level IPT while the 14 "D" level IPTs are at the "product" level.[Ref. 53] Each IPT is a multidisciplinary team with members from engineering, finance, quality assurance, procurement, etc.[Ref. 53] Each IPT is led by a GDLS employee who has a Government counterpart. The roles and responsibilities for Government participation on IPTs at the AAAV program is shown in Appendix E.

Primarily, the Government members on the IPTs serve as "customer" representatives. They are there to facilitate GDLS personnel getting information faster, thereby reducing cycle time.[Ref. 56] The Government members can provide their personal opinion or offer an "expert' opinion when asked by GDLS for the "Government position" or for an interpretation of the work required by the contract.[Ref. 56] The

Government members are not on the IPT to do any of GDLS's work as required by the contact. Finally, Government members cannot authorize any changes or deviations from the contract's SOW or authorize GDLS to perform additional work.

The use of IPPD/IPTs was new to both GDLS and the AAAV PMO.[Ref. 7] The personnel, though experienced in acquisition, were not used to working in an IPT environment. Having an expert consulting firm conduct training on IPTs solved this lack of experience.[Ref. 57] This training also established a baseline for both the GDLS employees and the AAAV PMO to build on.[Ref. 7] However, the training did not take place until six months after the collocation and IPT arrangement began.[Ref. 57] One thing that was learned soon after the IPTs began was that not everyone is cut out to be an IPT leader, requiring several personnel to be reassigned. [Ref. 53]

3. Contractor Cost Sharing

As part of their contract proposal, General Dynamics Land Systems (GDLS) proposed a unique cost sharing arrangement with the Government that was included in the contract. The complete clause is shown in Appendix F. As with most cost-reimbursement type contracts, the Government will reimburse GDLS for all allowable, allocable and reasonable costs, and pay them the appropriate Base Fee and Facilities Capital Cost of Money (FCCM). The original contract cost/fee arrangement shows a Total Estimated Cost (TEC) of $214,826,694 for Contract Line Item Numbers (CLINs) 0001 and 0002. These CLINs are for the Demonstration and Validation of the AAAV in

accordance with the contract Statement of Work and the associated Technical Data requirements. However, according to the Cost Sharing clause, the Government is only required to reimburse GDLS for these costs up to $205,007,988. The cost-sharing clause requires the contractor to then absorb all costs over $205,007,988 up to $214,826,694. Then, should the costs be greater than had originally been projected, the Government will then again reimburse GDLS for their costs over $214,826,694. The net result is a potential cost saving to the Government of almost $10 million while at the same time providing a powerful incentive for GDLS to reduce costs. The contractor will, however, still receive its base fee and any award fee while it is sharing costs with the Government.[Ref. 58]

Cost sharing in of itself is not unique. The FAR defines cost sharing as "an explicit arrangement under which the contractor bears some of the burden of reasonable, allocable, and allowable contract cost [Ref. 43:part 35.001]." Cost Sharing is also addressed in the FAR where it is described as a "cost-reimbursement contract in which the contractor receives no fee and is reimbursed only for an agreed-upon portion of its allowable costs."[Ref. 43:part 16.303] Typically, cost-sharing occurs when the Government contracts with a Federally Funded Research and Development Center (FFRDC) or other non-profit agency.

4. AAAV System Design Decisions

After the CD/V contract was awarded, an additional clause was added to encourage GDLS to make trade-offs which, while costing the Government more during the CD/V phase, would reduce costs in other phases of the program or Life Cycle Costs (LCC).[Ref. 58] The clause titled "Special Provision Regarding AAAV System Design Decisions" is shown in Appendix G. This clause was intended by the PM to move away from the "phony" trade studies that are typically conducted in an MDAP.[Ref. 7]

The System Design Decision provision encourages the contractor to submit to the Government trade-off decisions (referred to as "trades") that will be beneficial to the Government. These trades are different than normal contract changes because they require the contractor to give something up.[Ref. 7] The GDLS contract manager describes this new contract provision in this way [Ref. 53]:

> Traditionally, without this new contract provision, if you made a trade decision that has a Life Cycle Cost benefit but cost more in the current contract (in this case DEM/VAL) that cost increase would contribute to cost growth or overrun. In our case we have created a new contract provision that allows us to adjust the instant contract finances for the impact of that trade decision. This helps in making the appropriate design decision in the long run without adversely impacting the instant contract financials.

Here are two examples of how this new provision was applied. In the first example, a trade study was conducted on the Hydrodynamic Suspension Unit (HSU) to determine whether the GDLS baseline unit was better than several competitors' proposals.[Ref. 59] It was determined that an HSU designed by a competitor would offer

better reliability, weigh less, have better mass production abilities and result in Life Cycle Cost (LCC) savings of over $205 million.[Ref. 59] However, switching to the new HSU would increase the cost of the current contract by $2 million. GDLS offered this change which was accepted by the PM using the System Design Decision provision of the contract.[Ref. 59]

In the second example, the original baseline transmission proposed was a four-speed transmission provided by Allison Transmissions.[Ref. 59] A trade study was conducted to see if the baseline transmission or another built by Allison was a better value. The trade study concluded that a six-speed transmission produced by Allison, which already had been proven in commercial applications, was the better choice.[Ref. 59] As an example of the Government involvement in the IPT process, when Allison briefed GDLS on the transmission, a Government drive train engineer, a logistician, and a Marine Corps Maintenance Officer were present to ask questions and to see for themselves that the six-speed transmission was better.[Ref. 59] By increasing the CD/V contract by $4.2 million, the Marine Corps will save over $41 million in production costs and $71 million in LCC.[Ref. 59]

E. CHAPTER SUMMARY

This chapter has examined the Technology Base Development Program, the Concept Exploration phase, and the Concept Demonstration and Validation phase of the Advanced Assault Amphibious Vehicle program. Next, it described the types of

contracts used during each of these phases of the program and who awarded the contracts. This chapter then described the organizational structure of the AAAV Program Management Office and examined the unique contract clauses found in the CD/V contract.

The next chapter will analyze the contracting decisions and their impact on the AAAV program.

IV. AAAV CRITICAL CONTRACTING DECISIONS

A. INTRODUCTION

This chapter will analyze the contracting decisions that were presented in the previous chapters explaining the background of the Advanced Amphibious Assault Vehicle (AAAV) program. The focus of the analysis will be on the contracting organization, contract types used, and the impact of the unique contract clauses used by the AAAV Program Management Office (PMO).

B. CONTRACTING ORGANIZATION

The AAAV program is unique in that it has the Procuring Contracting Officer (PCO), the Administrative Contracting Officer (ACO) and a Contract Manager all collocated within the same PMO. No other Major Defense Acquisition Program (MDAP) is arranged this way. This section will examine the advantages and disadvantages associated with the collocation of these contract-related sections.

1. Defense Contract Management Command Relationship

The Defense Contract Management Command (DCMC) Program Support Team (PST) consists of eight personnel that are collocated with the AAAV Program Management Office (PMO). In addition to the ACO and a procurement technician; there are three engineers, a Government property specialist, a software specialist and the

Program Integrator (PI) assigned to the PST. These personnel are not chargeable to the Program Manager's (PM) Table of Organization (T/O). If DCMC did not provide these personnel, the researcher believes that the Marine Corps would not be able to afford replacing them on a one-for-one basis with new PMO personnel. As such, the PST provides the PM a tremendous benefit in terms of personnel resources. Additionally, because of the collocation and daily interaction with PMO personnel, the PST has a better understanding of the PMO than they would if located elsewhere and is more likely to feel like a member of the PMO "team."

The collocation affords the ACO a unique opportunity to interact daily with both the Procuring Contracting Officer (PCO) and the contractor in all contracting matters. As a result of the Integrated Product Team (IPT) concept used at the AAAV PMO and the daily interaction with the contractor, the ACO is able to complete tasks, such as contract modifications, in a much more timely fashion than would be able if not collocated. Because of the collocation, documents can be routed between the various offices within the AAAV PMO (e.g., ACO, PCO, GDLS, finance) quickly instead of being mailed and issues resolved by face-to-face meetings instead of over the telephone. Because of the collocation, it is much easier for the ACO to remain informed as to the program decisions being made that will result in contract modifications. The use of IPTs has allowed the ACO to use a process, similar to "Alpha Contracting", where the contractor is involved in the contract modification process, providing important input and recommendations in every step along the way. By the time a modification, such as for a design change,

reaches the Program Manager for a decision it has already been staffed and evaluated by both the contractor and Government teams. All the PM has to do is agree or disagree without having to route the request through the PMO. This process has significantly reduced cycle time.

2. Contract Manager

The Contract Manager, who heads the Contract Management section, provides additional contract related expertise to the AAAV PMO. The Contract Management section is not typically found in a PMO. In other PMOs, usually the Business and Finance section does much of the work performed by this section. Typically, the Business/Financial Manager (BF/M) provides additional contract assistance as a collateral duty in areas such as earned value management for the PM and without the benefit of formal contract training and experience.

Since the Contract Manager is not matrixed from another organization and works directly for PM, she can be assigned whatever duties the PM desires. This affords the PM a great deal of flexibility regarding contracting, since the other contract personnel (ACO and PCO) are matrixed into the PMO. The Contract Manager is responsible for handling the administrative requirements of the award fee process for the Concept Demonstration and Validation (CD/V) phase Cost-Plus-Award-Fee (CPAF) contract. This role is important because of the extra administrative effort a CPAF contract requires. The Contract Manager is responsible for collecting monthly comments on the

contractor's performance from the Program Management Team members, consolidating the reports and drafting a letter for the PM that appraises the contractor of their performance for the previous month. If the Contract Manager were not resident in the AAAV PMO, this administrative burden would fall on another section. Additionally, the Contract Manager is a voting member on the Award Fee Determination Board. Some of the other areas in which the Contract Manager provides expertise are preparing and coordinating modification requests, reviewing cost performance reports provided by the contractor, and analyzing/projecting cost growth and variances. Also, the Contract Manager provides a valuable second opinion, if needed, by the PCO and ACO since they are both matrixed away from their parent contracting organization.

There are potential drawbacks of having a separate, dedicated Contract Management Section within the PMO. First, since the title "Contract Manager" is not typically found in a PMO, it could cause confusion to an outsider unfamiliar with the organizational structure of the AAAV program. There are no indications, however, that the separate Contract Management section has been confused with the PCO or ACO. Second, the potential exists for conflict to arise between the Contract Manager and the PCO or the Contract Manager and the ACO. An example of a conflict could be the contractor addressing an issue to the Contract Manager instead of going to either the PCO or ACO, as appropriate. Another example of conflict could be the Contract Manager performing a duty that would normally be assigned to the PCO or ACO, like tracking payment to the contractor, which is an ACO responsibility. The AAAV PMO has several

mechanisms in place that helps minimize the potential for conflict to exist. To begin with, the IPT environment helps keep everyone informed as to what is occurring on a daily basis and the regular meetings help keep communications open. Next, formally documenting individual roles and responsibilities helps minimize conflict as well. The Contract Manager's responsibilities, shown in Appendix C, have been formally published by the PM. Also, a Memorandum of Agreement between the PM and the Defense Contract Management Command define the responsibilities of the ACO. These clearly defined responsibilities designate which contract section is responsible for which duties, thereby minimizing potential conflicts. The researcher did not find any evidence that there has been any conflicts that have arisen between the Contract Manager and the PCO or ACO.

C. CONTRACT TYPE DETERMINATION

The AAAV PMO, and the organizations supporting the AAAV program, have used three different contract types in the contracts awarded to support the program thus far. The three contract types are the Firm-Fixed-Price (FFP) contract, the Cost-Plus-Fixed-Fee (CPFF) contract and the Cost-Plus-Award-Fee (CPAF) contract. The next section of this chapter will examine the use of these three contract types and other contracting alternatives available.

1. Use of Firm-Fixed-Price Contracts

A Firm-Fixed-Price (FFP) contract has been used only five times during the history of the AAAV program. During the Technology Base Development portion of the program, a FFP contract was awarded to FMC to procure a new type of aluminum track that would save weight on the future AAAV. During the Concept Exploration (CE) phase of the program, a FFP contract was awarded to FMC and GDLS each to develop conceptual designs for the AAAV. Also during the CE phase, two FFP contracts were awarded to Motoren und Turbinen Union (MTU) for engine development. In each of these five cases, all of the contracts were completed within the original price of the contract and the Government's requirements were met.

An analysis of these FFP contracts shows that FFP contracts can be used successfully during the research and development of a major defense system if certain conditions are met. First, the PMO must adequately define the requirement, as was the case with the aluminum track contract. Second, the Government must ensure that the contractor understands that the contract price is indeed firm. This was the case with the two CE phase conceptual design contracts. The Government made it clear to both contractors that the price was firm and both adhered to the contracted price, while still meeting all of the Government requirements. Finally, contractors with a history of meeting Government's requirements within contracted price should be given favorable consideration when evaluating past performance. This applies in the case of the two engine development contracts awarded to MTU. According to PMO personnel, MTU has

a history of completing contracts, even cost-reimbursement type contracts, under the initially awarded contract price.

2. Use of Cost-Plus-Fixed-Fee Contracts

The Cost-Plus-Fixed-Fee (CPFF) contract is the most commonly used type of contract in the developmental stages of Major Defense Acquisition Programs (MDAPs). The CPFF contract has also been used extensively (over twenty times) throughout the Technology Base Development Program and in the CE phase of the AAAV program. Additionally, even though the contracts in support of the AAAV program were awarded by the Naval Sea Systems Command (NAVSEA); the Navy Regional Contracting Center (NRCC), Detachment, London; and the Marine Corps Research, Development and Acquisition Command (MCRDAC); all of these organizations saw fit to use CPFF contracts during the early stages of the program.

One benefit of a CPFF contract is that it requires less administrative effort than the other cost-reimbursement type contracts. This is because the CPFF contract pays the contractor a set, fixed-fee, regardless of the costs incurred. With a CPFF contract, the program office does not have the extensive administrative burden required by the award fee process of a CPAF contract. Minimizing the administrative effort required to manage a contract was important in the early stages of the AAAV program since there were only limited PMO personnel available to handle the administrative requirements of managing the contract. Also, not having to worry about administrative requirements freed the PMO

personnel to focus on other programmatic issues. Other cost-type contracts, like CPIF or CPAF contracts, could have been used instead of the CPFF contract.

Despite its extensive use, the CPFF contract type has a significant disadvantage over other cost-reimbursement type contracts: there is little the Government can do to incentivize the contractor to control costs. Because the contractor is already being paid a fixed fee while having all of its allowable costs reimbursed, there is little incentive for him to control costs. As such, the CPFF contract type should only be used when other contract types are not practical. However, given the uncertainties that lie in the developmental phases of a major defense acquisition, the use of the CPFF contract is usually appropriate.

3. Use of Cost-Plus-Award-Fee Contract

The AAAV PMO chose to use a Cost-Plus-Award-Fee (CPAF) contract for the Concept Demonstration and Validation (CD/V) phase of the program. A CPAF contract was chosen over the more common CPFF contract, or other types of cost-reimbursement contracts, for one reason. The CPAF contract, with its periodic award fee evaluations and Government determined award criteria, allows the PM to apply emphasis where he desires within the program. And, as the program evolves and priorities change, the PM can change the award fee criteria as necessary to reflect these changes in priorities and focus the contractor on the new priorities.

The drawback to the CPAF contract is it requires more Government administrative effort than the other types of cost-reimbursement contracts. In the case of the AAAV CD/V phase CPAF contract, the administrative effort of managing the award fee process was greater than had been expected. Originally, there was no formal feedback to the contractor planned other than the formal award fee review process at the end of each award fee period. Then, after the second award fee period the process changed. At the conclusion of the second award fee period GDLS was awarded significantly less fee than they had expected. The contractor was surprised because they had expected a much better evaluation of their performance, based on the informal feedback they were receiving at the working level. The concern expressed by GDLS over this caused the Government to institute a monthly feedback program. These interim evaluations let GDLS know how they are performing relative to the award criteria instead of having to wait until the formal review process at the end of the award fee period.

The researcher has concluded that the reason GDLS was surprised by the low amount of award fee they received at the end of the second award fee period is because of the informal feedback the GDLS employees received. The informal feedback resulted from the day-to-day contact with Government employees in the IPTs and led GDLS to believe they had met the Government expectations for each of the award fee criteria. However, this informal feedback came from the individual perspective of those employees at the working level and not from the Program Manager or the Award Fee Review Board (AFRB). As such, when all three of the second period criteria were

evaluated, the AFRB concluded that GDLS had not attained at least an acceptable rating in one of the criteria. This evaluation resulted in GDLS receiving zero award fee on a criterion that accounted for 40 percent of the award fee available for that period.

The disadvantage of providing feedback on a monthly basis is that the award fee program is more time consuming for both GDLS and the Government than before when only the final evaluation was provided. Providing feedback monthly is critical, though, in keeping the contractor informed and appraised of the PMO's evaluation of his performance. Therefore, if corrective action needs to be taken to ensure that the contractor is meeting the Government's expectations in order to receive the award fee, he has time to make the appropriate changes before the evaluation period ends.

Two important lessons have been learned during the CD/V phase regarding the administration of the award fee. First, the PMO must establish a thorough periodic review process that ensures the contractor understands whether or not he is meeting the PM's expectations for the award fee. This is especially important in an IPT environment, like that used in the AAAV program, where Government and contractor employees have daily contact. Without clear, concise feedback from the AFRB, the contractor may rely on the informal feedback received at the working level and assume that they are performing adequately to receive the full, or a substantial portion of, the award fee. Second, the PMO should look at previous experiences that the contractor has had with CPAF contracts to determine what their expectations may be on future contracts. This way, the PMO can let the contractor know at the first indication that they may not be

receiving the award fee percentage that they have typically received on previous contracts or expected to receive during this award fee period. In the case of GDLS, they were used to receiving 90 to 95 percent of the available award fee per period on previous contracts with the U.S. Army. This may have led the contractor to believe that the award fee was "automatic" and they would receive a substantial portion of the fee regardless of the quality of performance.

D. IMPACT OF UNIQUE CONTRACT CLAUSES

The AAAV PMO has used several unique contract clauses in the Concept Demonstration and Validation (CD/V) contract. These clauses have given the PMO additional tools in which to incentivize the contractor and to facilitate the development of the AAAV. The four unique clauses in the contract with GDLS are: (1) specified geographic location of the contractor's office with Government collocation, (2) contractor use Integrated Product and Process Development (IPPD) concepts and Integrated Product Teams (IPTs), (3) contractor cost sharing, and (4) a Special Design Decision Provision. The next section of this chapter examines the unique contract clauses and their impact on the program.

1. Impact of Geographic Location and Collocation

> The contractor's AAAV Washington, D.C. Research and Development Facility shall be located within 20 minutes travel by car of Springfield, Virginia, the intersection of Interstate 95, 395, and 495.[Ref. 54:p. SOW-4]

> The facilities (offices, spaces, furniture and equipment) to be provided shall be equal to those provided by the Contractor for its use for personnel and other Government personnel assigned to support the AAAV program. The facilities provided shall be collocated with the contractor's AAAV Washington, D.C. Research and Development Facility.[Ref. 54:p. 134]

The typical MDAP PMO is geographically separated from the contractor. Not only do the PMO and contractor work in separate facilities; they are usually not even located in the same city or state. As such, communications between the contractor employees and members of the PMO are limited to telephone conversations, e-mails, faxes and infrequent (usually quarterly) face-to-face visits. This geographic separation creates a communication problem as well as delays in resolving issues. Furthermore, it helps contribute to an "us versus them" mind set. With the requirement of collocation, instead of only seeing each other on an infrequent basis, the Government and contractor personnel see each other daily. The collocation has also facilitated the requirement for the contractor to implement additional initiatives, namely Integrated Product and Process Development (IPPD) concepts and Integrated Product Teams (IPTs), which are discussed later.

As discussed in the previous chapter, General Dynamics Land Systems (GDLS) chose an office located in Woodbridge, Virginia, approximately halfway between the Pentagon and Quantico, Virginia. The geographic location of the AAAV PMO has been beneficial in several ways. First, both the Pentagon and the Marine Corps Systems Command are each less than a 20-minute drive from the PMO. The close proximity to Washington has helped facilitate briefings to important acquisition personnel on every

level of staff: Secretary of Defense; Department of the Navy; and within Headquarters, U.S. Marine Corps. Access to Marines with amtrac experience at Quantico has helped the contractor get valuable input on system design decisions from potential future AAAV users. Second, moving to a new facility helped break both the PMO and the contractor away from their respective headquarters and create the "cultural change" envisioned by the PM. Finally, the geographic location has helped expose GDLS employees to the Marine Corps through the unique training and orientation program as discussed in the previous chapter. Additional benefits of the collocation are explained below.

a. Benefits of Collocation

Probably the single biggest factor in the success of the AAAV program has been the collocation of contractor and Government employees in the same facility. Collocation has improved the communication between the contractor and the Government and has significantly reduced the time it takes to make program decisions. If a question or issue arises from either side, it can be quickly answered or resolved by just walking down the hall to the other party. Collocation has been essential in improving communications, developing a better relationship, and ultimately increasing the trust between the PMO and GDLS. Collocation has also been invaluable in allowing the use of the CPAF contract and teaming.

Collocating at a new facility had the additional benefit of allowing GDLS the opportunity to "hand select" the core personnel that would be moved to work on the

AAAV program. This ensured that only the highest quality, most dedicated personnel would be working on the program. This has had a great impact in the ability of the contractor to implement Integrated Product and Process Development (IPPD) processes, since all of the employees moving to the new facility knew they would be working in a "teaming" environment. Had GDLS been allowed to pick the site of the facility, they may have chosen a location near their headquarters in Sterling Heights, Michigan. If so, they may have been less likely to send their best personnel to work on the project since they would be close or collocated with their own division headquarters.

Since the AAAV PMO already existed in Arlington, Virginia, they all moved to the new facility when it became available in September 1996. At this time, the PCO collocated from Marine Corps Systems Command (MARCORSYSCOM) in Quantico while the ACO collocated from DCMC Manassas. It is the researcher's belief that had the Government not mandated the specific geographic location in the Washington, D. C. area the contractor would have remained at or near their existing corporate headquarters in Michigan to design the AAAV. The researcher also believes that the AAAV PMO would have remained in the northern Virginia area, either at its existing office in Arlington or at MARCORSYSCOM in Quantico, and not collocated with the contractor. Not collocating would have prevented the highly successful implementation of teaming concepts and the exposure of the contractor to its customer, the Marine Corps.

b. Disadvantages of Collocation

Despite the fact that key contractor employees were "hand selected" to move to the new facility, there is a concern expressed by both GDLS and Government employees over relocating away from the relative security of corporate offices or a large Government office. This concern stems from the belief among some employees that moving to a smaller, isolated office away from their parent organization's key facilities would be harmful to their career and limit their future opportunities. Because of the limited number of personnel within each specialty at a small, isolated office, promotion opportunities would be limited. Also, fear of moving away from an office where there might be ten people all doing the same type of work to an office where the employee would be the only one performing a particular type of work caused anxiety. The counter to this argument from the GDLS Contracts Manager is that the skills learned working in the IPPD/IPT environment are making the GDLS employees very valuable within the company. In the future, many will be able to relocate within the company to another office or program and use their expertise to assist the conversion to this new way of doing business.

Another risk of collocation is that the constant daily contact could cause an unduly familiar relationship between the contractor and PMO staffs. This could potentially result in inflated evaluations of the award fee criteria and lead to unearned fee being awarded to the contractor. There is no evidence, however, that this has occurred in the AAAV program. The fee evaluation process at AAAV program is conducted with the

same rigor expected on any program and, in fact, GDLS has received less award fee on the AAAV CD/V contract than on other contracts, as has been previously discussed.

2. Teaming

> The Government and the contractor agree to utilize and Integrated Product and Process Development (IPPD) approach including the concept of "TEAMING" in managing this program.[Ref. 54:p. H-24]

Use of the Integrated Product and Process Development (IPPD) process is new and both AAAV PMO and GDLS personnel were unfamiliar with it at the beginning. In some cases the IPPD process required a "cultural change" from the way things were done in the past. This could have become a major stumbling block to the success of the program. As stated in the Department of Defense Guide to Integrated Product and Process Development: [Ref. 60]

> Given current approaches, cultural change is required for the IPPD process to work. Because of the hierarchical structure of the military services, adaptation to the IPPD method of doing business may be difficult due to the changing roles of the different staffs. This perception can become more pronounced as differences in rank increase. It is essential that an atmosphere with freedom to express ideas without repercussion from those conflicting views is created. *Recommendation: Do not underestimate the forces of resistance to change. Spend what may seem like an inordinate effort on cultural change management. To the maximum extent possible, utilize a rewards system to recognize and encourage the desired change.*

Even though the IPPD process appears to be running smoothly at the AAAV program, the requirement in the contract that the contractor utilize IPPD practices is actually not recommended in the DoD Guide to IPPD. The Guide states that "A series of

'approved, recommended, or best practices' for applying IPPD should not be contractually imposed." The concern is that by directing the use of IPPD they will become "standards by implication and contractors will be hesitant to deviate from them for fear of being found non-responsive."[Ref. 60]

The Guide further recommends selecting a contractor that already has "established an IPPD culture and should not need steps for implementation dictated by DoD." This is a valid recommendation as long as a metric for IPPD implementation is included in the source selection criteria used when determining which company to award a contract. General Dynamics Land Systems did not have any experience with IPPD, but by including the requirement in the SOW the Government ensured that the contractor would use the IPPD process, even though they had not used it in the past. Additionally, by providing a specific definition of what was expected in the contract, the Government ensured that the IPPD process being utilized was the version the Government desired, not just the contractor's version of IPPD.

Utilizing the IPPD approach can result in significant benefits to both the contractor and the Government. By integrating all facets of the program from the very beginning, the program manager and contractor should be able to avoid costly mistakes by identifying potential problem areas early in the program. Additionally, overall costs and the time required for the program are reduced while still maintaining a high quality product that meets the SOW. This is different from the traditional approach where the contractor and program office are organized on functional lines. The main problem with

the traditional organization of a program management office is that without the integration of the many functional areas, problems are overlooked or not identified until late in the development of the program when the cost of changes are high. The end result of not working together is overall higher program costs and delays. By using an IPPD process, the bulk of changes occur early in development, when change costs are low, resulting in lower program costs.

The two most important characteristics of IPTs are cooperation and empowerment.[Ref. 61] Cooperation is essential for teams to be successful. Team members must have an equal voice in the decision making process. Each member, with their own unique area of expertise, needs to be recognized by the other IPT members but this does not mean that their particular view is the "right" one. There can be disagreement on how to approach a particular issue, but that disagreement must be reasoned disagreement based on an alternative plan of action rather than unyielding opposition.[Ref. 61] Issues that cannot be resolved within the IPT need to be elevated as quickly as possible to the next level IPT for early resolution. The researcher found no evidence that there were problems in resolving disagreements or conflicts within IPTs at the AAAV program.

One important fact is that Government IPT members do not lead the IPT or make the decisions. The IPTs belong to GDLS and the Government members are there to assist in the process, not control it. Current guidance provided to Government members of AAAV IPTs is that they do not approve or disapprove of IPT decisions, plans or

reports. They are members of the IPT to offer their opinion in the development of IPT decisions, plans or reports, and to vote as a member of the IPT.[Ref. 35] Government members are expected to coordinate with their supervisor to ensure that they are passing the "Government" opinion to the IPT. Additionally, Government members of IPTs do not have veto power over decisions made by the IPT.[Ref. 35]

The "D" level IPTs, as described in the previous chapter, are "product IPTs" and have the most impact on the program. It is at the "D" level where the individual components and systems of the AAAV are designed. The "D" level IPTs have been assigned their share of the cost and weight as well as being responsible for the performance of their "product". As a result, while engineers in other programs would be concerned about little else than the performance characteristics of the component or system they were designing, engineers on the AAAV program are now integrated into a team where they have to also be concerned about issues such as cost.[Ref. 53]

a. Training Integrated Product Teams

Integrated Product Team training was not conducted before the IPTs began meeting. This resulted in poorly organized IPT meetings that were ineffective and inefficiently used IPT member's time. The contractor and the AAAV PMO quickly learned that the IPT process required training and skills, such as how to conduct an effective meeting, which many acquisition personnel did not already possess. Consequently, a training program was established that all GDLS and Government

The intent of the training was to teach the employees how to work in an IPT environment and to establish an IPT baseline for all personnel, both contractor and Government, from which to build.

Traditional, classroom type training was conducted first to give the AAAV IPT members a foundation of skills necessary to succeed in the IPPD environment. The contractor used a consulting firm to conduct training for all IPT members, both contractor and Government, on topics such as "How to run an effective meeting".[Ref. 53] Additionally, the Government hired a consultant to teach Stephen Covey's "Seven Habits of Highly Effective People" and Marine Corps officers provided leadership training to all IPT members.[Ref. 53] This training helped establish the common baseline necessary to make the IPTs successful.

b. Concerns for Teaming

There are a number of potential drawbacks to the use of IPTs. One issue with the use of IPTs is what to do if there is an "adversarial" representative on the team that is causing problems whenever possible. This type of behavior would most likely be expected when the member in question had not undergone the "cultural change' previously mentioned and was unwilling to go along with the new process. The first course of action is to try to deal with the problem within the IPT. If the IPT cannot resolve the problem, then it immediately is raised to the next level of decision making. [Ref. 62]

A second drawback to IPTs is that participation in them takes time. Personnel that are members of several different IPTs could potentially be involved in IPT meetings every day. Each of the IPTs within the AAAV program meets at least once per week.[Ref. 53] Since most Government and contractor personnel are on two or more different IPTs, this may mean that they are in meetings three to five hours per day. GDLS schedules IPT meetings every day of the week except Fridays.[Ref. 63] The amount of time spent in meetings raises the concern over the size of the staff required to sit on all of these IPTs. Some program managers may feel that they will have to increase the size of their staff to support IPTs. This is especially difficult in a time of diminishing personnel resources. So, when IPT meetings are convened, they must be formally structured and well-planned to avoid non-productive time. This may not happen without the proper training and guidance. Additionally, a mechanism such as a computer database should be available that stores IPT meeting minutes and is available to those members that are not able to attend a meeting. The database should also contain the proposed agenda for upcoming meetings so IPT members can be prepared for the meeting before it begins. The AAAV PMO has such a database, called the Virtual Design Database, and it is used to store IPT information as well as numerous other documents.

3. Contractor Cost Sharing

> The Contractor shall absorb 100% of its costs incurred...from the point where its total costs incurred equals $205,007,988 until its total costs incurred shall equal $214,826,694, and the Government shall have no obligation to reimburse the Contractor for any such costs...[Ref. 54:p. B-3]
>
> In the event the total estimated costs incurred...should exceed $214,826,694 and the Contracting Officer elects to proceed with contract performance, the Government shall...reimburse the Contractor for 100% of its allowable, allocable and reasonable costs incurred...in excess of $214,826,694.[Ref. 54:p. B-3]

General Dynamics offered a cost-sharing arrangement as part of its proposal for the CD/V contract. The cost-sharing provision is shown in Appendix F. The cost-sharing arrangement was used by GDLS as one way to make their proposal more competitive. There are two benefits to this provision in the contract. First, this provision allows the Government to save approximately $10 million of the estimated cost during the CD/V phase. Second, the cost-sharing proposal has the potential to be effective in incentivizing GDLS to control costs and keep them under the amount where cost-sharing begins, since they will not be getting reimbursed for up to $10 million of their estimated costs, if costs incurred exceed $205 million.

The researcher has concluded that GDLS offered the cost-sharing arrangement as a competitive tool to help them receive the contract. The contractor may have also thought they would be able to achieve some sort of efficiency during the performance of

the contract that would allow them to keep costs under the amount where they begin absorbing all costs.

The researcher believes that the cost-sharing clause will be effective in saving the Government approximately $10 million in one of three ways. First, if the cost-sharing provision successfully incentivizes the contractor to stay under the $205 million cost amount where they begin absorbing all costs, then the provision was effective in reducing the contract costs to less than had been expected. Second, even if the contractor reaches the point where they begin absorbing costs, but stay under the $214.8 million cost amount, then the provision was again successful in saving the Government the amount of cost that the contractor absorbed. Finally, even if the contractor exceeds the cost-sharing amount and the Government again begins reimbursing the contractor for its allowable costs, the Government will still have saved approximately $10 million that it would have reimbursed the contractor without this clause. If this clause is determined to have been effective once the contract is completed, the Government should consider using it in other contracts as a way to incentivize the contractor to reduce costs.

It is the conclusion of the researcher that the contractor has no incentive to exceed the estimated cost of the contract since doing so would affect his cost performance in the Earned Value Management System and could potentially jeopardize the entire program. Even if the contractor tried to overrun the estimated cost in an attempt to recover his costs by "making work", he would still be out the $10 million in costs he incurred (and submitted vouchers for) during the cost-sharing period. Because of the close working

relationship and insight resulting from the collocation and IPT environment, it would be difficult for the contractor to submit erroneous vouchers in an attempt to make up for the costs it absorbed.

The researcher believes a cost overrun could potentially jeopardize the program in several ways. First, if the overrun was excessive, the AAAV program could be cancelled. Second, if the overrun exceeded the funds that were available to the AAAV PMO to pay for the CD/V contract, then they would have to ask for additional funding, which would bring unwanted attention to the program. Finally, if funding was not available, then the AAAV PMO would have to delay work that could potentially delay the Initial Operational Capability (IOC) date of the AAAV.

4. System Design Decision Provision

> ...situations may occur in which...trade-off analyses clearly indicate the desirability of design decisions which would significantly increase the Contractor's costs of performance during the Demonstration/Validation (Dem/Val) Phase because of substantially greater long-term benefits to the AAAV Program resulting from anticipated savings in subsequent Program Phases and/or lower life cycle costs throughout the service life of the AAAV.[Ref. 54:p. H-31]
>
> ...if the Government determines that the overall, long-term benefits to the Marine Corps substantially outweigh the additional costs to be incurred by the Contractor during the Dem/Val Phase, the Contract will be equitably adjusted to reflect the Contractor's anticipated increase in Dem/Val costs (including FCCM and fee) resulting from the design decision.[Ref. 54:p. H-32]

The final unique contract provision examined is the System Design Decision Provision shown in Appendix G. This provision was developed by the AAAV PMO as a means to incentivize GDLS to make effective, realistic trade studies. The clause incentivizes the contractor to make design changes because in addition to being reimbursed for increased costs to the instant contract, the contract will also be adjusted to reflect increased Facilities Capital Cost of Money (FCCM) and fee. Without this clause, the contractor would only have its allowable costs reimbursed for design changes that result in additional cost to the Government on the instant contract but would not receive any FCCM or fee based on the increased cost. Additionally, without this provision, the contractor would be penalized in the cost portion of the Earned Value Management System since the additional cost would be treated as a cost overrun.

Here is an example of how the Special Design Decision Provision works. If the contractor determines during a trade study of transmissions that designing the AAAV to support transmission X costs $2 million more than designing it to support transmission Y, and transmission Y offers similar performance to transmission X but saves the Government $25 million in life-cycle costs, this special provision would allow GDLS to be reimbursed for their allowable costs and still receive additional FCCM and fee.

The System Design Decision Provision is similar in some ways to a Value Engineering Change Proposal (VECP). Both clauses are based on the contractor proposing a change in the contract that will result in a cost saving to the Government. A significant difference between them, however, is that with the System Design Decision

Provision, the instant contract will cost more and the cost savings to the Government will result in the future as explained in the preceding section. With the VECP, the savings to the Government occur on the instant contract as well as similar concurrent and future contracts. An additional difference is that VECP clauses are used in production contracts and are not suitable for a development effort.

The researcher believes that the System Design Decision Provision has been effective in incentivizing the contractor to conduct effective trade studies. This conclusion is based on two trade studies which have been conducted that have resulted in $2,256,265 in additional cost to the Government but will result in anticipated production cost savings of $38,797,900 and operation and support cost savings of $205,000,000 over the expected life of the AAAV.

E. CHAPTER SUMMARY

This chapter analyzed the contracting decisions that were made during the course of the Technology Base Development program, the Concept Exploration phase and the early stages of the Concept Demonstration and Validation phase of the AAAV program. The researcher determined that appropriate contracting decisions had been made and that the unique contract clauses used in the CD/V contract were valuable in incentivizing the contractor. The geographic location required by the contract, coupled with the collocation of the contractor and the AAAV PMO, have also had significant positive benefits.

The next chapter presents the researcher's conclusions, recommendations and answers the primary and subsidiary research questions.

V. CONCLUSIONS AND RECOMMENDATIONS

A. INTRODUCTION

The focus of this research effort was to examine the contracting decisions that have been made during the early phases of the Advanced Amphibious Assault Vehicle (AAAV) program. The history of the AAAV program was presented along with the contracting organizations, the contract types, and special contract clauses used. This chapter will draw conclusions from the research effort and subsequent analysis that has been presented. Recommendations will then be made as to how the successful lessons learned from the AAAV program may be applied to other acquisition programs. Finally, areas for further research will be presented.

B. CONCLUSIONS

1. Collocation of the AAAV Program Management Office (PMO); the contractor, General Dynamics Land Systems (GDLS); and the Defense Contract Management Command (DCMC) Program Support Team (PST) has provided tremendous benefits to the overall program.

Collocation of the contractor, the PST and the AAAV PMO has been the important factor in the success of the AAAV program. The daily interaction between Government and contractor employees has helped create trust and build a bond between the two parties, minimizing the traditional "us versus them" mentality that exists in many

programs. At the AAAV program, communications are not limited to telephone calls and occasional face-to-face meetings. Instead, collocation has allowed constant daily interaction that has improved the communications process tremendously. Finally, collocation has allowed the highly successful implementation of the Integrated Product and Process Development (IPPD) process and Integrated Product Teams (IPTs).

2. The use of Integrated Product and Process Development (IPPD) concept with Integrated Product Teams (IPTs) has significantly improved the relationship between the Government and the contractor while reducing the cycle-time required to implement changes.

The AAAV PMO mandated the use of IPPD and IPTs in the Concept Demonstration and Validation (CD/V) contract. The IPPD process has resulted in problems being identified and resolved quickly. More importantly, by using IPTs, the problems are being resolved early on in the program when it is both cheaper and quicker to implement the solutions. Since the IPTs are comprised of both contractor and Government members, a close relationship has developed between the members as the IPTs work together as a team to solve problems.

3. The use of the Special Design Decision Provision has been effective in incentivizing the contractor to conduct realistic trade studies that have resulted in significant life-cycle cost (LCC) savings for the AAAV program.

The Special Design Decision Provision was added to the CD/V contract in order to incentivize the contractor to conduct realistic trade studies. Without this special provision, any design changes made by the contractor that resulted in greater cost to the

Government would be treated as a cost overrun and not subject to additional base and award fee (profit) for the contractor. This provision allows the contractor to have his costs reimbursed for a design change as well as receive additional profit.

4. The geographic location of the contractor's facility as mandated in the contract has been beneficial in facilitating a "cultural change" necessary to implement IPPD and exposing the contractor to the Marine Corps.

The geographic location required by the contract forced the contractor winning the CD/V contract to move away from its corporate headquarters to a new facility in the Washington, D.C. area. This allowed the contractor to carefully select the employees that would be moving to the new facility to work on the AAAV program. The contractor could select those employees that were agreeable to working in a teaming and IPPD environment, thereby ensuring that this new way of doing business would not be met with resistance. Additionally, by moving away from the corporate headquarters, the contractor's AAAV team was unencumbered by constant corporate oversight and allowed to try innovative processes and management techniques. Finally, the close proximity to Marine Corps units in Quantico, Virginia, has facilitated exposure of contractor employees to the Marine Corps. This has allowed contractor employees to gain a better understanding of their "customer."

5. The Cost-Plus-Award-Fee (CPAF) contract type used by the AAAV PMO during the Concept Demonstration and Validation (CD/V) phase has been effective in incentivizing the contractor.

The CPAF contract used in the CD/V phase of the AAAV program is divided into ten award fee periods. Each period has different award fee criteria that the AAAV PMO uses to evaluate the contractor to determine to what extent the contractor is meeting the Government requirements. If the contractor is not meeting Government designated award fee criteria, then they will not get the full amount of award fee available to them. This contract type appears to provide the Program Manager a great deal of leverage over the contractor in ensuring that the Government expectations are met on the contract.

6. There are challenges with IPTs that must be identified and resolved prior to using IPTs.

Integrated Product Teams are an excellent way to create a team environment necessary for innovative change to occur in a program. However, training must be conducted prior to using IPTs so that all team members have a common baseline of knowledge about teaming before beginning the process. The training should include techniques for conducting effective meetings and time-management. The meetings associated with IPTs take a significant investment of time and the PMO must be prepared for this. Finally, not everyone has the requisite skills to be an effective IPT leader and plans must be made to identify potential personnel problems that may arise during the conduct of the IPT sessions.

C. RECOMMENDATIONS FOR DOD

1. Program offices should be collocated with their prime contractors, where practicable.

Collocation has been one of the most important factors in the success of the AAAV program. Collocation has improved communications between the Government and the contractor and facilitated the implementation of innovative processes like IPPD and the use of IPTs.

2. Program offices should use the IPPD concept and IPTs, where practicable.

The benefits to be gained through early identification and resolution of potential problems by using IPPD concepts and IPTs are significant. Every effort must be made to overcome "cultural biases" or any other resistance to move away from the traditional approach to program management. Additionally, quality training must be provided to IPT members so they can learn the skills necessary to be successful in the IPPD environment.

3. The Special Design Decision Provision used in the AAAV program CD/V contract should be adopted for use during the design stages of other acquisition programs.

The Special Design Decision Provision used the AAAV program has been very beneficial as a means to reduce production and life-cycle costs. This provision has provided an incentive to the contractor to conduct realistic trade studies that while costing the Government more during the design phase of the program should result in significant production and life-cycle cost savings.

4. Program Management Offices should take steps to expose contractors to the customer so the contractor has a better appreciation of the customer and their needs.

The AAAV program implemented the successful program explained in Chapter III to expose the contractor to the Marine Corps. This exposure to the Marine Corps has

helped give the contractor a better appreciation of their customer, helped foster a stronger working relationship, and is helping to design a better vehicle.

D. ANSWERS TO RESEARCH QUESTIONS

This section answers the study's primary and subsidiary research questions based on the background and analysis provided in the previous chapters. Since the subsidiary questions support the primary question, they will be answered first.

Subsidiary Question #1. What was the Advanced Assault Amphibian (AAA) concept and how did it lead to the establishment of the AAAV program?

The AAA concept evolved from the requirement to land Marines ashore from ships stationed over-the-horizon. The AAA concept included any means possible to accomplish the ship-to-shore movement, not necessarily by an amphibious vehicle. In order to determine which method was most effective, the Marine Corps examined 13 different alternatives that included high-water speed amphibious vehicles, low-water speed amphibious vehicles, non-amphibious vehicles, and non-vehicles. A Cost and Operational Effectiveness Analysis concluded that a high-water speed amphibious vehicle, the AAAV, was the most effective alternative.

Subsidiary Question #2. What was the initial acquisition strategy of the AAAV program and how has it evolved?

The initial acquisition strategy in 1988 was to procure 1400 AAAVs with an Initial Operational Capability of 4th quarter, Fiscal Year 1999 (FY-99). The plan was to use multiple contractors and cost-plus-fixed-fee (CPFF) contracts for both the Concept

Exploration (CE) and Concept Demonstration and Validation (CD/V) phases of the program. Because the technological risk of the vehicle was studied extensively and due to funding issues, the program was delayed. However, three sets of risk reduction contracts were awarded during the CE phase of the program that reduced the risk adequately enough that the AAAV PMO was able to down-select to only one contractor during the CD/V phase. By down-selecting to only one contractor, instead of using two or more contractors as had been originally planned, the AAAV PMO was able to implement collocation and more effectively use the IPPD concept and IPTs. The current acquisition strategy is to produce 1013 AAAVs with an IOC of 3rd quarter FY-06.

Subsidiary Question #3. What was the organizational structure used to effectively execute the acquisition strategy of the AAAV program?

The organizational structure of the AAAV program evolved into a unique Program Management Office. The AAAV PMO is collocated with contractor and also includes the Procuring Contracting Officer (PCO) and Administrative Contracting Officer (ACO). Additionally, the PMO contains a separate Contract Management section that also assists in the contracting effort. The PMO and contractor are organized into 28 Integrated Product Teams (IPTs) that work together very effectively in designing the AAAV and executing the acquisition strategy.

Subsidiary Question #4. What have been the contracting vehicles used during the AAAV program and how effective have they been?

The AAAV PMO has effectively used both cost-reimbursement and fixed-price type contracts. The most frequently used contract type has been the Cost-Plus-Fixed-Fee

(CPFF) contract, which is typical in the developmental phases of a program. Firm-Fixed-Price (FFP) contracts were used successfully on five occasions when the requirements of the contract were well-defined and the risk to the contractor was low. The Cost-Plus-Award-Fee (CPAF) contract being used in the CD/V phase has been very effective in incentivizing the contractor to focus his efforts on meeting the specific criteria defined in the award fee plan.

Subsidiary Question #5. To what extent has the AAAV program used special contract clauses?

The AAAV program has successfully used several special contract clauses. In the CD/V contract, the AAAV program mandated the geographic location of the contractor's facility, collocation of the AAAV PMO with the contractor, and the use of an IPPD concept with IPTs. The CD/V contract also contains a Special Design Decision Provision that helps incentivize the contractor to make realistic trade studies that hold the potential to significantly reduce production and life-cycle costs of the AAAV.

Subsidiary Question #6. What impact has IPT/IPPD had on the contracting effort within the AAAV program?

The use of the IPPD concept and IPTs has been very successful in keeping the contracting personnel informed and involved in the program. Within the IPT framework, the contracting personnel and the contractor work together in developing solutions to issues that arise, such as design changes that result in contract modifications. By involving the contractor throughout the decision making process, cycle time has been significantly reduced.

Subsidiary Question #7. How might an analysis of the contracting decisions made in the early phases of the AAAV program be used in the successful execution of other defense acquisition programs?

The contracting decisions made in the AAAV program will be beneficial to other defense acquisition programs because they show the successful implementation of the IPPD concept, IPTs, a unique PMO organization and use of special contract clauses. Additionally, other defense acquisition programs can look at the unique provisions of the CD/V contract, like collocation and the Special Design Decision Provision, for ideas on ways to improve their program and provide additional means to incentivize their contractors.

Primary Research Question: What have been the critical contracting decisions and events regarding the AAAV Program and how have these affected the nature and scope of the AAAV Program as it exists today and how will an analysis of these critical decisions and events affect the future development, production, and deployment of the AAAV?

During the Concept Exploration phase of the AAAV program three sets of risk reducing contracts were awarded. Also during this timeframe, the Technology Base Development Program was gaining critical knowledge that would be used in developing key systems in the future AAAV. These activities successfully reduced the risk enough that the AAAV program was able to down-select to one contractor during the CD/V phase of the program. By only using one contractor during the CD/V phase, the AAAV program was able to mandate that the contractor locate its design facility in the

Washington, D.C. area, that the PMO collocate with the contractor and that the contractor use the IPPD concept and IPTs.

These critical decisions have helped create a "cultural change" and an environment within the PMO and contractor that has been receptive to new, innovative ideas. This environment and the use of the IPPD concept and IPTs has allowed the contractor to identify problems early on in the program where they take less time and are much cheaper to correct. This environment has also helped reduce cycle time, thereby ensuring that the AAAV program remains on schedule, despite changes that have occurred in the program. The use of the Special Design Decision Provision has incentivized the contractor to make realistic trade studies that have resulted in significant production and life-cycle cost savings. These decisions will help ensure that the AAAV remains within budget and is delivered on time.

E. AREAS FOR FURTHER RESEARCH

During this research effort several other areas were discovered that warrant further study. First, the AAAV PMO is unique in that its contracting organization includes the PCO, ACO and a Contract Manager. An analysis into this organizational structure would be beneficial in determining if the role of the Contract Manager would be beneficial in other Major Defense Acquisition Programs (MDAPs). Second, the Systems Design Decision Provision of the CD/V contract is unique to the AAAV program. A detailed analysis into its benefits would be useful in determining to what extent this clause, or one like it, could be used during other phases of MDAPs. Finally, the

collocation of the AAAV PMO with the contractor in a new facility geographically separated from the contractor's corporate headquarters has been beneficial in creating a "cultural change" within the program. A study that examines how receptive major defense contractors would be in entering into similar arrangements in the future with other MDAPs would be beneficial in determining if collocation can be mandated in other programs.

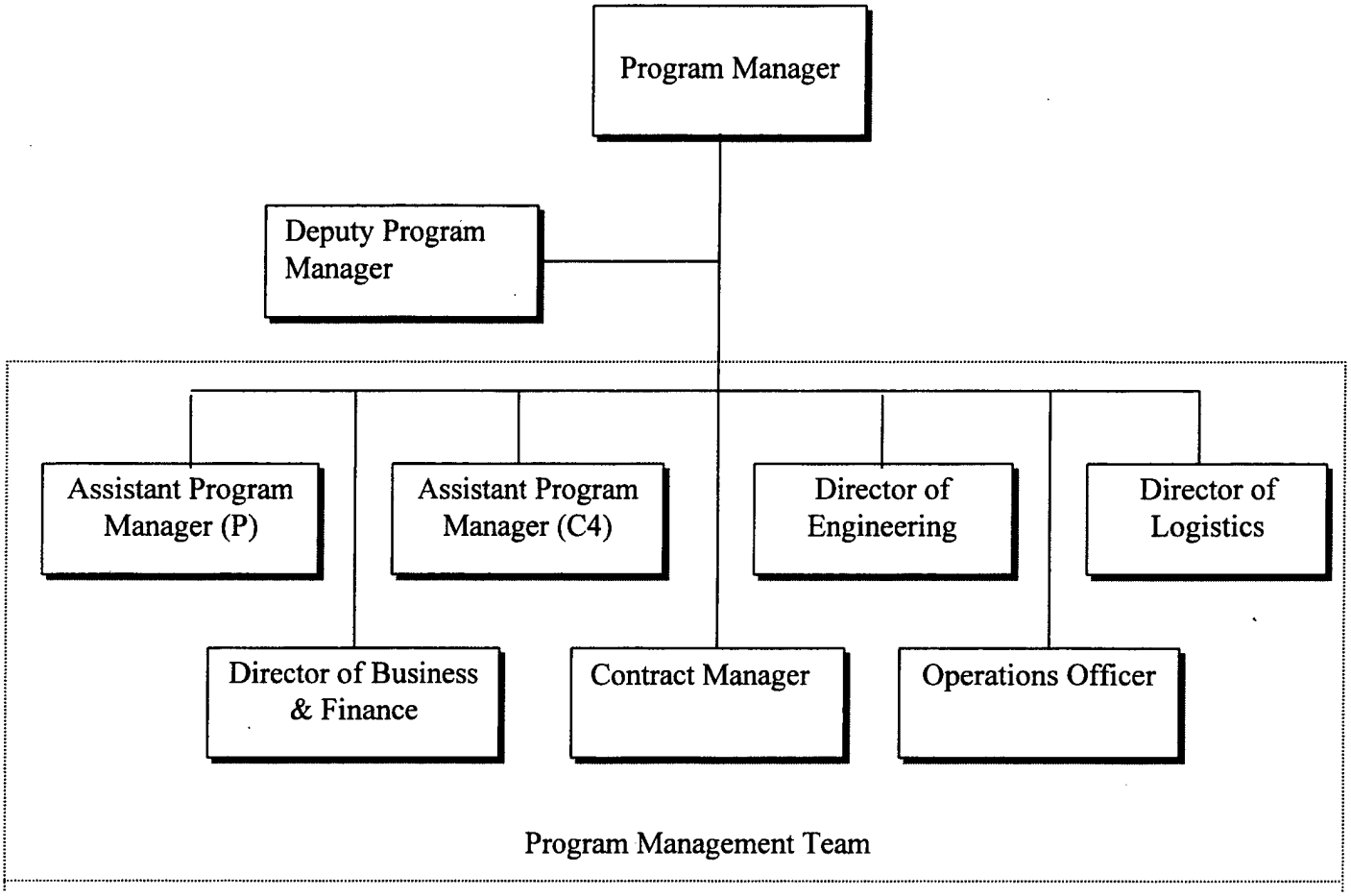
APPENDIX A: GLOSSARY OF ACRONYMS

AAA	Advanced Amphibious Assault
ACAT 1D	Acquisition Category 1D
ACO	Administrative Contracting Officer
ACV	Air Cushion Vehicle
ADM	Acquisition Decision Memorandum
AFRB	Award Fee Review Board
AMTRAC	Amphibian Tractor
ATR	Automotive Test Rig
AAV	Assault Amphibian Vehicle
AAAV	Advanced Amphibious Assault Vehicle
ASN(RDA)	Assistant Secretary of the Navy for Research, Development and Acquisition
AWS	Amphibious Warfare Strategy
AWSA	Amphibious Warfare Surface Assault
AWT	Amphibious Warfare Technology
BAFO	Best And Final Offer
BF/M	Business and Financial Manager
CAIV	Cost As an Independent Variable
CD/V	Concept Demonstration and Validation
CE	Concept Exploration
CG, MCDEC	Commanding General, Marine Corps Development and Education Center
CG, MCRDAC	Commanding General, Marine Corps Research, Development and Acquisition Command
CLIN	Contract Line Item Number
CMC	Commandant of the Marine Corps
CNO	Chief of Naval Operations
COEA	Cost and Operational Effectiveness Analysis
COMMMARCORSYSCOM	Commander, Marine Corps Systems Command
COMNAVSEA	Commander, Naval Sea Systems Command
CPAF	Cost-Plus-Award-Fee
CPFF	Cost-Plus-Fixed-Fee
CPIF	Cost-Plus-Incentive-Fee
DAB	Defense Acquisition Board
DAWIA	Defense Acquisition Workforce Improvement Act
DoD	Department of Defense
DoN	Department of the Navy
DCAA	Defense Contract Audit Agency
DCMC	Defense Contract Management Command
DRPM	Direct Reporting Program Manager
DRPM AAA	Direct Reporting Program Manager Advanced Amphibious Assault

DTRC	David Taylor Research Center
EMD	Engineering and Manufacturing Development
FAR	Federal Acquisition Regulation
FCCM	Facilities Capital Cost of Money
FDO	Fee Determination Official
FFP	Firm-Fixed-Price
FFRDC	Federally Funded Research and Development Center
FMC	Food Machinery Corporation
FY	Fiscal Year
GDLS	General Dynamic Land Systems
HCA	Head Contracting Agency
HSU	Hydrodynamic Suspension Unit
HWSTD	High-Water Speed Technology Demonstrator
ICE	Independent Cost Estimate
IFV	Infantry Fighting Vehicle
IOC	Initial Operating Capability
IPPD	Integrated Product and Process Development
IPT	Integrated Product Team
J&A	Justification and Approval
LAV	Light Armored Vehicle
LCAC	Landing Craft, Air Cushioned
LCVP	Landing Craft, Vehicle and Personnel
LSF	Landing Ship Fast
LVA	Landing Vehicle, Assault
LVT	Landing Vehicle, Tracked
LVT-1	Landing Vehicle, Tracked Model 1
LVT(X)	Landing Vehicle, Tracked (Experimental)
MAA	Mission Area Analysis
MAGTF	Marine Air-Ground Task Force
MARCORSYSCOM	Marine Corps Systems Command
MCDEC	Marine Corps Development and Education Center
MCPDM	Marine Corps Program Decision Meeting
MCRDAC	Marine Corps Research, Development and Acquisition Command
MDAP	Major Defense Acquisition Program
MENS	Mission Element Need Statement
MNS	Mission Needs Statement
MOA	Memorandum Of Agreement
MS	Milestone
MSARC	Major Systems Acquisition Review Committee
NAE	Naval Acquisition Executive
NAVSEA	Naval Sea Systems Command
NBC	Nuclear, Biological and Chemical
NSWC-CD	Naval Surface Warfare Center - Carderock Division

OAT	Office of Advanced Technology
OMFTS	Operational Maneuver From The Sea
ONR	Office of Naval Research
ORD	Operational Requirements Document
OTH	Over-The-Horizon
PCO	Procuring Contracting Officer
PDA	Program Decision Authority
PDM	Program Decision Memorandum
PDRR	Program Definition and Risk Reduction
PEO	Program Executive Officer
PI	Program Integrator
PIP	Product Improvement Program
PLCCE	Program Life-Cycle Cost Estimate
PM	Program Manager
PMAAV	Project Manager, Assault Amphibian Vehicles
PMO	Program Management Office
POM	Program Objective Memorandum
PSD	Propulsion System Demonstrator
PST	Program Support Team
RDT&E	Research, Development, Test and Evaluation
RFP	Request For Proposal
ROC	Required Operational Capability
SECNAV	Secretary of the Navy
SESSO	Surface Effects Ship Support Office
SCRE	Stratified Charge Rotary Engine
SLEP	Service Life Extension Program
SSAC	Source Selection Advisory Council
STOM	Ship To Objective Maneuver
UDLP	United Defense Limited Partnership
USD(A)	Under Secretary of Defense, Acquisition

APPENDIX B: AAAV PROGRAM MANAGEMENT TEAM



Source: AAA Brief 31 Dec 96 to ACMC

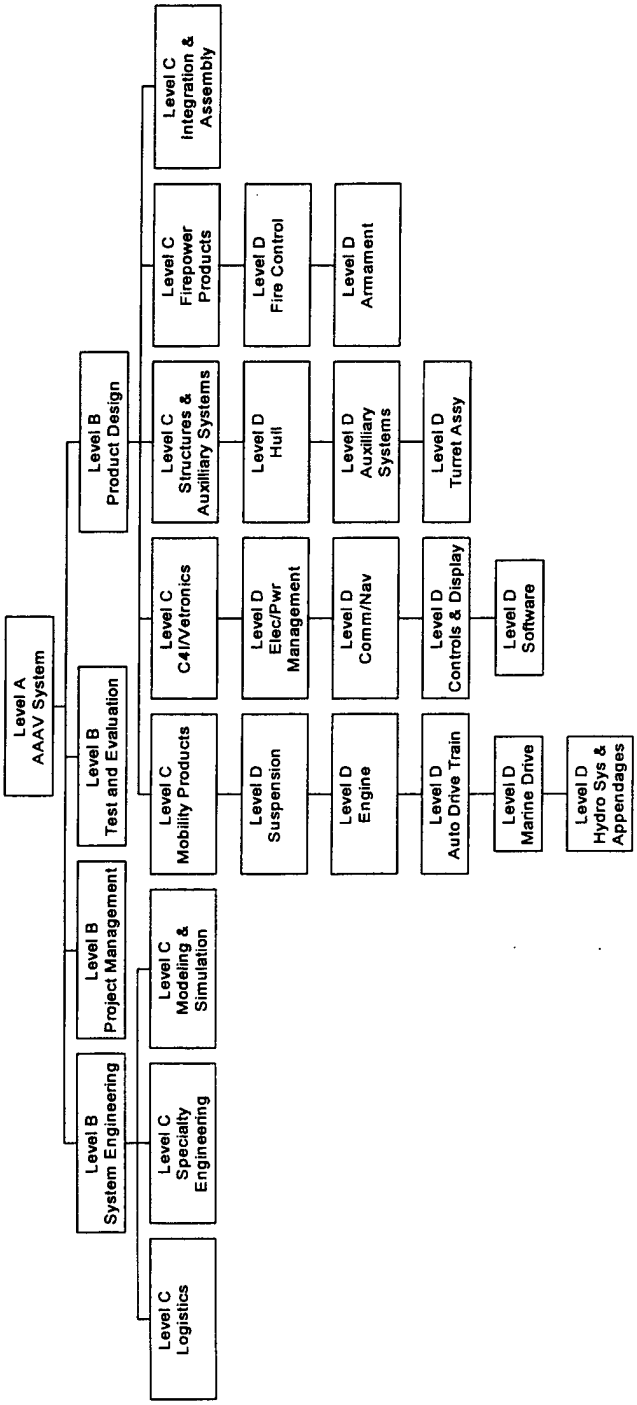
APPENDIX C: DUTIES AND RESPONSIBILITIES OF THE CONTRACT MANAGER

1. C/SCSC - CPR analysis (cost, schedule, control, baseline reviews)
2. Acquisition Plan Sponsor
3. CDRL Sponsor (administration/tracking)
4. Government Furnished Equipment (Administrative tracking with Logistics)
5. Procurement Documents Assistance (PCO/ACO/Legal Issues)
    - MRs/PRs
    - CDRLs
    - Statement of Work
    - Source Selection Plans
    - Monitors flow of Procurement documents
    - Maintains DRPM Contract Documents

6. Manage Support Contract
7. Life Cycle Cost Estimate Sponsor
8. Cost Analysis
9. Contract Closeout
10. Business Contracting Officer's Representative on Concept Demonstration Validation Contract - funds tracking, availability, FARs, etc.
11. Award Fee Administration
12. DCMA interface
13. Part-time IPT leader and full-time member on the Program Management Team
14. Supervisor
15. Responsible for budget planning, reporting, and execution of all internal funds to support assigned tasks.

Source: DRPM, AAA ltr 30 Jul 96 Enclosure(1) page 6

APPENDIX D: AAAV INTEGRATED PRODUCT TEAMS



APPENDIX E: GOVERNMENT IPT PARTICIPATION

1) The IPTs are GDAS run entities. We do not lead or manage the IPTS.

2) We serve as "customer" representatives on the IPTS. We are there to REDUCE THE CYCLE TIME of contractor-Government (customer) communication. In other words, we facilitate GDAS personnel getting Government input faster. Government IPT members also enable us to provide GDAS IPT Status and issue information up the government chain on a daily basis (instead of monthly or quarterly).

3) WE DO NOT DO GDAS's IPT WORK, or any portion of their work or tasks. GDAS has been contracted to perform the tasks outlined in the contract SOW; their personnel and their subcontractors' personnel will perform those tasks, not us.

4) When asked by GDAS personnel for the Government's position or interpretation, Government IPT members can offer their personal opinion, as an IPT member, or offer expert opinion; you can provide guidance as to our "customer" opinion and what might be acceptable to the Government but you can only offer the "Government" position for items that have been agreed to by you and your Supervisor. IT IS UP TO YOUR SUPERVISORS TO EMPOWER EACH OF YOU TO AN APPROPRIATE LEVEL OF AUTHORITY. It is expected that this will start at a minimal level of authority and be expanded as each individual's IPT experience and program knowledge grows. However; (see items 5 & 6)

5) Government IPT members CAN NOT authorize any changes or deviations to/from the contract SOW or Specifications. If/When an IPT concludes that the best course of action is not in accordance with the contract, and a contract change is in order, then GDAS must submit a Contract Change Request (CCR) through normal channels. (See Contract Clause H.8, page H-1 5 of the contract).

6) Government IPT members CAN NOT authorize GDAS to perform work that is in addition to the SOW/contract requirements. GDAS IPTs can perform work that is not specifically required by the contract, at their discretion (provided they have time and budget, in theory).

7) Government IPT member participation in GDAS IPT activities IS NOT Government consent that the work is approved by the Government or is chargeable to the contract. If an [PT is doing something questionable, identify it to your supervisor/PMT member.

8) Government members of IPTs do not approve or disapprove of IPT decisions, plans, or reports. You offer your opinion in their development, you vote as a member, and you coordinate issues with your Supervisor and bring the "Government" opinion (in the form

of your opinion) back to the IPT, with the goal of improving the quality of the products; you don't have veto power.

9) You each are Government employees First (representatives of the Taxpayers, the Department of Navy, the United States Marine Corps, and the Program Manager), and IPT members second. We each are still subject to all the Government laws and regulations regarding "directed changes", ethics, and conduct.

APPENDIX F: SPECIAL CONTRACT REQUIREMENT REGARDING COST SHARING

In accordance with the Contractor's Cost Proposal dated 28 February 1996, as amended by the Contractor's Best and Final Offer dated 01 June 1996, it is understood and agreed that the parties will share the allowable, allocable and reasonable costs incurred in the performance of CLINs 0001-0002 in the following manner.

a) In accordance with the provisions of the clause of this contract entitled "ALLOWABLE COST AND PAYMENT (Jul 1991)," FAR 52.216-7, the Government shall reimburse the Contractor for 100% of the allowable, allocable and reasonable costs incurred by the Contractor in performance of its obligations under CLINs 0001-0002 of the contract until such time as the total of such costs incurred equals $205,007,988. It is further understood and agreed that the Contractor shall be entitled to receive Base Fee and FCCM with respect to any incurred costs up to $205,007,988.

b) The Contractor shall absorb 100% of its costs incurred under CLINs 0001-0002 from the point where its total costs incurred equals $205,007,988 until its total costs incurred shall equal $214,826,694, and the Government shall have no obligation to reimburse the Contractor for any such costs, notwithstanding the clause entitled "ALLOWABLE COST AND PAYMENT," or any other provision of this contract to the contrary. It is further understood and agreed that the Contractor shall not be entitled to receive Base Fee or FCCM with respect to any incurred costs which it absorbs pursuant to this agreement.

c) In the event the total estimated costs incurred under CLINs 0001-0002 should exceed $214,826,694 and the Contracting Officer elects to proceed with contract performance, the Government shall, subject to the provisions of the clause entitled "ALLOWABLE COST AND PAYMENT," reimburse the Contractor for 100% of its allowable, allocable and reasonable costs incurred under CLINs 0001-0002 in excess of $214,826,694.

d) During the period when the Contractor will absorb 100% of its incurred costs in accordance with paragraph b), above, the Contractor shall continue to submit invoices in compliance with Section G.1. of the Contract. Each invoice shall be decremented to indicate the Contractor's cost share for the period covered by the invoice and the net costs, if any, owed by the Government. Each invoice shall also indicate the cumulative total of costs absorbed by the Contractor to date pursuant to this agreement.

e) This agreement shall be modified, as necessary, to adjust the points at which the Contractor's cost sharing obligations shall commence and terminate, as a result of any changes to the total estimated amount for CLINs 0001-0002 which may be effected during contract performance.

Source: AAAV CD/V Contract

APPENDIX G: SPECIAL PROVISION REGARDING AAAV SYSTEM DESIGN DECISIONS

a) It is mutually understood and agreed that critical decisions made by the Contractor in designing the Advanced Amphibious Assault Vehicle (AAAV) System will be based upon the results of whole system core capabilities cost/performance trade-off analyses, as well as subsystem and component cost/performance trade-off analyses, which will consider overall AAAV Program objectives such as vehicle weight, combat effectiveness, design-to-unit production cost (DTUPC) and total life cycle cost (LCC) for the AAAV System.

b) It is further recognized that situations may occur in which such trade-off analyses clearly indicate the desirability of design decisions which would significantly increase the Contractor's costs of performance during the Demonstration/ Validation (Dem/Val) Phase because of substantially greater long-term benefits to the AAAV Program resulting from anticipated savings in subsequent Program Phases and/or lower life cycle costs throughout the service life of the AAAV.

c) In recognition of the above, the parties mutually agree that whenever the Contractor shall consider making a design decision which the Contractor reasonably expects to significantly increase its costs of certain Dem/Val Phase effort (approximately $500,000 or greater) over the estimated costs included by the Contractor for such effort in its Best and Final Offer for the Dem/Val Phase Contract, the Contractor may submit to the Contracting Officer:

1) the Contractor's estimated Dem/Val costs to implement the contemplated design decision, with supporting documentation;

2) the Contractor's estimate of Dem/Val costs for other acceptable design alternatives;

3) the detailed basis for the Contractor's estimate for the effort contained in its Dem/Val Cost Proposal;

4) the Contractor's assessment of the anticipated long-term benefits to the AAAV Program associated with the design decision; and

5) any additional supporting documentation requested by the Contracting Officer.

d) Upon consideration of the above information, if the Government determines that the overall, long-term benefits to the Marine Corps substantially outweigh the additional costs to be incurred by the Contractor during the Dem/Val Phase, the Contract will be equitably adjusted to reflect the Contractor's anticipated increase in Dem/Val costs (including FCCM and fee) resulting from said design decision.

e) It is understood and agreed that, except with respect to design decisions implemented prior to the effective date of the modification incorporating this clause into the Contract, no request for equitable adjustment hereunder will be considered unless the Contractor's request was received and fully considered by the Government prior to effecting the design decision. It is further understood and agreed that, with regard to any design decision for which an equitable adjustment is made pursuant to this clause, the Contractor shall not be entitled to submit any subsequent change proposals pursuant to the clause of this contract entitled "VALUE ENGINEERING (MAR 1989)," FAR 52.248-1.

f) The Contractor further agrees that decisions regarding equitable adjustments to the contract under this clause are within the sole discretion of the Government. Accordingly, any decision(s) by the Government that the Contractor shall not be entitled to an equitable adjustment hereunder with regard to any contemplated design decision(s) shall not be subject to the provisions of the clause of this Contract entitled "DISPUTES - ALTERNATE I (DEC 1991)," FAR 52.233-1, and the Contractor hereby releases the Government from all liability and forever waives any actual or potential entitlement to any equitable adjustment in the price (cost and fee) and/or delivery schedule of this Contract as a result of any such decision(s).

Source: AAAV CD/V Contract

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